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NOTES FOR THE MONTH.

CONSEQUENT on the formation of a new Government, Mr. Noel Buxton, Member of Parliament for North Norfolk, has been appointed Minister of Agriculture and Fisheries. Mr. W. R. Smith, Member of Parliament for Norwich, has been appointed Parliamentary Secretary.

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THE publication of the Final Report of the Departmental Committee on Distribution and Prices of Agricultural Produce brings to an end a task which has occupied the Committee for practically a year. Appointed on the 18th December, 1922, the Committee has held 71 meetings and heard oral evidence from 225 witnesses, representative of producers, distributors and consumers. In addition a vast amount of information was collected direct from distributors by means of questionnaires. Four interim reports have been presented dealing with (1) Milk and Milk Products, (2) Fruit and Vegetables, (3) Meat, Poultry and Eggs, and (4) Cereals, Flour and Bread.

The Final Report deals on broad lines with the main problem of marketing and distribution, and is comparatively short, comprising less than 50 pages. In it the Committee has endeavoured to bring together in a summary form some of the principal points which have been brought out in the course of its inquiry, and in particular to supply a reasoned explanation of some of the causes of the difference between the prices received on the one hand by the producer and paid on the

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other hand by the consumer. The Report contains an interesting chapter on co-operation as applied to the sale of agricultural produce—the causes of past failures are discussed and some useful suggestions made as to future developments. The Committee also makes recommendations as to the granting of State loans to producers' organisations, the collection and publication of price statistics and other questions. The concluding chapter of the Report deals with the need for further and continuous investigation into methods of marketing agricultural produce, and generally into the economics of agriculture.

The Report can be obtained through any bookseller, or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C.2, price 3s. 1½d., post free.

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IN view of the great value of lucerne as a fodder crop, it might profitably be much more extensively grown, particularly in the southern and midland counties and on soils containing a sufficient proportion of lime. An account of lucerne and its cultivation is given in the Ministry's Leaflet

**Lucerne in the
First Century
A.D.**

No. 160. As a fodder crop for horses, cattle and pigs, it is highly valuable, while it may be converted into hay which is equal to the best clover hay. Some care is needed to get it established, but once growing strongly, it will yield four cuttings a year for from four to eight years.

In this connection it may be of interest to quote the old Roman writer, Columella, who shows us that even in the 1st Century A.D., agriculturists in Italy possessed a sound knowledge of lucerne and esteemed it very highly. He writes thus:—

“Of the more popular fodder crops, lucerne is the best; once sown it will last for 10 years, and can be mown easily four times, often six times, a year. It enriches the soil; any stock in poor condition will get fat on it; it has a salutary effect on ailing animals; a jugerum (say $\frac{3}{4}$ acre) will keep three horses for a year. The method of sowing is the following:—The land on which the lucerne is to be sown in the following spring should be roughly ploughed about 1st October and allowed to weather all the winter. On 1st February go over it again, removing all the stones and breaking up the clods. Then some time in March give it its third ploughing and harrow it. After

having thus got a good tilth, lay out plots, like garden beds, 10 ft. wide by 50 ft. long, so that water can be led along the intervening paths, and the labourers can have access on both sides to hoe. Then apply well rotted manure, and sow at the end of April at the rate of a cyathus (about 1/12th pint) of seed to a plot 10 ft. by 5 ft. Immediately after sowing, cover the seed with wooden rakes (harrows). This is a very useful proceeding, as the seeds quickly become parched by the sun. After sowing, no iron implement must touch the crop. And, as I have said, it must be harrowed with wooden harrows and frequently weeded, to prevent other plants killing the unestablished lucerne. The first crop should be taken rather late, after it has shed some of its seed. Afterwards it may be cut young, when it has made some growth, and given to stock, but only sparingly at first, until they get accustomed to it, lest the novelty of the fodder should injure them. For it blows stock and causes full-bloodedness. After it has been cut, water frequently. A few days afterwards, when it begins to shoot again, weed out all other plants. So treated it will last 10 years and give six crops a year." (L. Junius Moderatus Columella, Bk. II, Ch. xi.)

THE growth and extension in the south-eastern counties of schemes for the systematic provision of expert advice on the

Rationing of Milch Cows.

rationing of milch cows are worthy of mention, and some of the factors which have led to this movement may be noticed. It is well known that during, and since, the War a number of new feeding stuffs have come on the market, notably the derivatives of the palm oil industry, formerly almost a monopoly of Germany. In the absence of experience, farmers had little to guide them in the use of these commodities. At the same time the greater attention which is being given to the individual performance of cows as a result of the spread of milk recording, has led to a more general recognition of the need of regulating feeding more in accordance with yield. Experience has also shown that old standards of feeding must be abandoned if the best results are to be obtained from the deep milkers (1,000 gallons and over) which are now to be found in herds. There are authenticated cases in which a heavy-yielding cow has consumed upwards of 20 lb. of concentrated food daily with no traceable evil effects on

her constitution. The day is long past, therefore, when cows could be fed economically on an all-over standard. Individual rationing more in accordance with yield and individuality is necessary, and, moreover, expert advice on the compounding of the ration becomes a necessity. This advice cannot be limited to a single occasion. Prices of concentrated feeding stuffs vary from day to day, and it becomes necessary to compare and compound food stuffs which vary not only in their chemical composition but in their comparative cost per food unit as well.

Now, while it must be admitted that Agricultural Organisers and others have always been ready and competent to advise in individual cases submitted to them, it has been found that farmers are, generally, much more ready to receive advice than to solicit it. The scheme which experience has shown to be most successful in the Home Counties is one under which, with the approval and support of the local Milk Recording Society, the Milk Recorder on his periodical visits to a farm fills up a printed form containing full details of the quantities of food being fed to the cows and sends a duplicate to the Adviser (normally the County Agricultural Organiser). The latter, thereupon, applying his expert knowledge, returns the form to the farmer concerned with a report on the suitability of the rations, adding, if necessary, suggestions for modification in order to secure economy and increase the milk yield.

Experience has shown, too, that in very many cases under expert guidance, better use can be made of home-produced food, such as roots, hay and straw; and that *over* feeding of *low* yielding cows, and *under* feeding of *deep* milkers, is not uncommon. The savings in cost effected, vary from 1d. to 6d. per gallon.—savings, too, which are immediately apparent in the cash returns from the business of milk production. What must be emphasized, however, is the value of an organised scheme for the provision of advice, founded upon co-operation between a Milk Recording Society and a County Organiser.

In evidence of the extent to which schemes of this description are in operation, and are rapidly extending, in the south-eastern counties, the following brief particulars are appended. They have been supplied by the courtesy of Messrs. McCreath, Garrad, and Jesse, Organisers for the counties of Essex, Kent, and East Sussex, respectively. It is only right to add that the extension of these schemes is largely due to the labours of Mr. J. Mackintosh of the National Institute of Dairying, Reading.

and Mr. G. H. Garrad, Agricultural Organiser for Kent, pioneers of the movement in Berkshire and Kent.

Kent.—An organised scheme of advice on rationing has been in operation in Kent for many years. The foundations were laid by Messrs. Mackintosh and Garrad when members of the staff of Wye College under the headship of Mr. M. J. R. Dunstan, now Principal of the Royal Agricultural College, Cirencester. An outstanding and successful feature of the scheme has been the prominence given to comparative cost of production figures. In the year 1922-23, 168 food records were submitted for advice through official Milk Recorders. They related to 100 different herds of which 42 were Shorthorns and 10 Friesian, the rest being either mixed breeds or small herds of Guernseys, Ayrshires and others. An analysis of the returns shows that the cost of food varied from 6d. to 13d. per gallon with a variation of daily yield from 28 lb. to 20 lb. per cow. The most typical results were given by a group of 59 herds in which the cost varied from 8d. to 11d. per gallon.

East Sussex.—A rationing scheme was inaugurated in this county in 1919. During last season (1922-23) 413 food records were examined and reported on. Of 218 members of the local Milk Recording Society, no fewer than 187 regularly ration their cows on the basis of advice furnished by Mr. Jesse, the County Organiser. In the Fourth Annual Report of the East Sussex Milk Recording Society, a striking illustration is given of the value of studying the feeding and production of a milking herd.

“During the winter of 1921-22 two herds in the same district were producing milk at a difference in cost (for food alone) of 8d. per gallon. The herds were similar in size but average production per cow per herd varied between 720 gallons per year and 440 gallons.

“The winter production of herd ‘A’ was 7,917 gallons, costing £313 7s. 7d. It would have cost herd ‘B’ £577 5s. 7d. to produce a similar quantity of milk, a difference of £263 18s. These figures illustrate the impossibility of economic production from a low average herd.”

In the case of another large herd, the cost of the ration in January, 1923, was 10½d. per gallon: when modified in accordance with expert advice, the cost was reduced to 8½d. per gallon. This was equivalent to a saving in the cost of food for the whole herd of £1,662 in the six winter months. The Local Authority has published a very useful leaflet containing a large number of sample rations for maintenance and production.

Essex.—During last season (1922-23) 255 food records were examined, relating to 47 herds. As a result of the scheme, the average all-over cost per gallon during last winter was only 8½d. per gallon. Another interesting figure is the estimated cost of grazing during the six winter months, viz., £9 15s. 6d. per cow. The progress of the scheme in this county has been promoted by the assistance given by Mr. J. B. Gill, the Secretary of the local branch of the National Farmers' Union.

Similar schemes have recently been adopted in the counties of Surrey, West Sussex, and Hertfordshire. Good progress has been made and there is every reason to expect that the movement will rapidly extend.

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THERE appears to be some misconception in certain parts of the country as to how, and by whom, the *initial steps* in the

**Agricultural
Credits Act, 1923.**

organisation of an agricultural credit society should be taken. Under Section 2 of the Agricultural Credits Act, 1923, the Government are empowered to make advances to agricultural credit societies, who, in turn are entitled to grant loans to their members for approved agricultural purposes, for periods not exceeding 5 years. An agriculturist can only benefit under this section by becoming a member of an agricultural credit society, and it rests entirely with local agriculturists to initiate the formation of a credit society for their mutual assistance. If there are persons in any agricultural district who desire to obtain loans under this scheme, their first action should be to meet together and examine the possibilities of founding a society in the district, and of obtaining a sufficient number of members to make it a success. In so doing, the promoters would be well advised to communicate with the Agricultural Organisation Society, 40, Broadway, Westminster, S.W.1, who are ready to help in the formation of credit societies. In addition to this, the Ministry has prepared certain memoranda which may be used as guides, setting forth the necessary steps to be taken, to establish a credit society, to effect its registration under the Industrial and Provident Societies Acts, and to obtain from the Ministry the money advances to which such societies are entitled. To enable a credit society to be registered under the Industrial and Provident Societies Acts, it is necessary for it to adopt rules

setting out its constitution, its method of operation, and the manner in which it must be conducted, in order to conform with the provisions of these Acts and the Agricultural Credits Act, 1923. For the purposes of assisting societies in preparing their rules, model rules which have been approved by the Ministry and the Chief Registrar of Friendly Societies, have been prepared, and may be obtained from H.M. Stationery Office, Imperial House, Kingsway, W.C.2.

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THE Ministry hopes to announce at an early date the conditions under which scholarships for the sons and daughters of agricultural workers will be awarded for the next academic year. The value of these scholarships is such that no outlay on the part of parents or scholar is necessary during the tenure of the scholarships. The scheme, which was instituted two years ago, has achieved a considerable measure of success, and it is most desirable that the facilities afforded by it should be widely known. At present, 13 students are taking degree courses in agriculture or an allied subject at Universities; 20 are taking diploma courses at Agricultural Colleges; and about 70 are attending Farm Institutes, etc., for short courses in agriculture, horticulture, dairying, or poultry-keeping.

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EVERY effort is being made to ensure that the Agricultural Research Exhibits at the British Empire Exhibition will be intelligible and interesting to both the agricultural and the urban public. It is realised that it is not sufficient to get together a representative, judiciously selected, well displayed and labelled exhibit. The experience of museums and picture galleries has conclusively proved that a collection of this kind may be, as far as the general public is concerned, a mere mausoleum. Those who are scientifically trained can pick their way through such a collection and discover the material of which they are in search, but only because they are trained to know what to look for. Until a few years ago, it was for this class and for this class alone that museums catered; now, however, museums have begun to make an appeal to the widest possible circle, and they have found that the one sovereign method of throwing open their collection to the public, is to engage the services of com-

potent guide lecturers who will, at intervals during the day, explain the significance of selected specimens in the galleries.

The forthcoming agricultural exhibit at the British Empire Exhibition will therefore be explained and demonstrated to the public on the lines adopted by the most popular museums. With the assistance of the Research Institutes and Agricultural Colleges of Great Britain—who are contributing the bulk of the collection—an exhibit has been brought together which will not only illustrate all the aspects of modern research, but which explains the scientific side of modern farming, the forces which make for success, and the forces which have to be kept in check.

Fuller details of the exhibit will appear in later issues of the *Journal*. Here it must suffice to say that eight principal divisions have been made:—Animal breeding and nutrition (including dairying); veterinary science; soils; plant breeding; plant pathology; horticulture; agricultural machinery; and agricultural economics. The divisions will be so arranged in the hall as to tell a continuous story—of the soil and its manuring and working, of crops and animals in health and disease, and the methods of combating disease. Qualified guide-lecturers will attend to explain at stated times the significance of the specimens and pictures, to supplement printed programmes and guides, and to put into words the story which the initiated the cases will tell.

THE decline in the prices of agricultural produce, which was very sharp in 1921 and 1922, was much less marked in the

**The Annual
Index Number of
Agricultural
Prices.**

past year, the average of the prices of all commodities sold off farms in 1923, after making due allowance for the relative importance of the different articles, being 57 per cent. above the average of 1911-13.

The decline as compared with 1922 was therefore only 12 points, as compared with reductions of 50 and 73 points respectively in the previous two years:—

Year.		Percentage Increase in the Prices of Agricultural Produce as compared with the three years 1911-1913.	
1915	27
1916	60
1917	101
1918	132
1919	158
1920	192
1921	119
1922	69
1923	57

Prices generally have been at about the same level in 1923 as in 1916, but grain, hay and potatoes were much below the 1916 level, and milk, dairy produce, eggs, fat sheep, fruit and hops considerably above. The decline as compared with 1922 was not due to any great extent to falling prices during 1923—in fact the monthly index numbers of prices during the greater part of 1923 showed comparatively little variation—but mainly to the higher prices in the first eight months of 1922, after which a sharp fall took place. During the last four months of 1922 the average increase over pre-war was very little different from that of the corresponding period of 1923.

Most commodities were cheaper than in 1922, and potatoes were relatively the cheapest, being only 13 per cent. above pre-war. During the first six months of the year, when the very heavy crop of 1922 was being marketed, wholesale potato prices in the large towns were lower than in 1911-13, being about 30 per cent. below from April to June. The new crop, which was small, has sold at much higher figures, realising from 60 to 90 per cent. above pre-war.

On the average cereals were appreciably lower in price than in 1922, but wheat was 1d. per cwt. and barley 10d. per cwt. dearer, with oats 5d. per cwt. cheaper, in December than a year earlier. Apart from potatoes, cereals on the whole showed a relatively smaller increase over 1911-13 than any other commodity, averaging only 26 per cent. above. Hay was also comparatively cheap, being only 30 per cent. above pre-war, but since the new crop, which was heavy, came on the market prices have declined, and during November and December were no higher than before the War.

Over the whole year milk averaged 74 per cent. above 1911-13, or only 5 points less than in 1922, and was one of the dearest commodities. Butter showed little change from the previous year at 59 per cent. above pre-war, but cheese which was relatively cheaper than butter in 1922 advanced to 69 per cent. above pre-war. The percentage increases as compared with 1911-13 in milk, butter and cheese respectively were more uniform in 1923 than in any year since the end of the War. Eggs declined from 93 per cent. above 1911-13 in 1922 to 68 per cent. above in 1923, but at the end of the year were dearer than in December, 1922. Poultry also showed a fairly similar decline.

Fat cattle, sheep and pigs all realised reduced prices, but sheep remained at a higher level than other fat stock. Fat cattle prices were comparatively steady during the year and at the close were practically the same as at the end of 1922, but in the case of sheep the usual autumn rise did not bring prices up to the level of December, 1922. Fat pigs have become much cheaper during the past year. At the end of 1922 they were practically double the pre-war price, whereas in December, 1923, they were only about 40 per cent. above.

Fruit crops in 1923 were poor and prices were consequently high, averaging more than double 1911-18. Vegetable prices generally followed much the same course as potatoes, being low in the first half of the year and comparatively high in the second half, and over the whole year averaged 48 per cent. above pre-war against 96 per cent. above in 1922. Hops yielded lighter crops than in the previous year, and the average price was fixed by the Hop Control at £13 per cwt. against £10 10s. per cwt. for the 1922 crop.

Wool showed a further rise in price in 1923, and at the summer wool sales averaged 44 per cent. above pre-war, as compared with only 14 per cent. above in 1922.

Percentage Increase in the Prices of Agricultural Produce during the years 1916 to 1923, as compared with the average of the three years 1911-13.

Commodity.	1916.	1917.	1918.	1919.	1920.	1921.	1922.	1923.
Wheat	79	132	123	123	147	119	46	30
Barley	88	128	108	167	215	84	41	19
Oats	68	151	149	164	187	72	47	35
Fat Cattle	58	105	111	132	163	127	63	51
Fat Sheep	57	97	110	136	187	117	100	87
Fat Pigs	67	126	166	176	230	128	87	65
Hay	52	57	87	157	192	51	40	30
Potatoes	88	137	79	135	206	132	79	74
Milk	57	91	151	200	203	163	79	74
Butter	36	77	109	115	199	115	61	59
Cheese	49	103	133	169	140	71	43	69
Poultry	36	69	159	127	141	112	92	73
Eggs	59	111	258	255	239	142	93	68
Fruit	38	54	311	218	279	183	88	117
Hops	19*	9*	93	113	105	111	23	52
Wool	46	62	74	208	253	16*	14	44
Beans and Peas	70	170	377	219	188	96	80	86
Vegetables	54	188	157	157	119	146	96	48

* Decrease.

THERE has been a steady decrease in the number of premises found to be affected with foot-and-mouth disease in recent weeks. In the week ending 29th December, the number was 320; in that ending 5th January, 256; in that ending 12th January, 193; and in the week ending 19th January, 115. A similar decrease is to be noted in the figures for Cheshire,

where the disease is far more prevalent than in any other county in Great Britain. This will be seen from the following figures from Cheshire:—Week ending 29th December, 212; week ending 5th January, 160; week ending 12th January, 110; and in the week ending 19th January, 63. The improvement in the position is also shown in the fewer cases of suspicion of disease reported to the Ministry, and in the very few new centres of disease which are being discovered. It is too early still to prophesy that the outbreak will speedily be terminated, but the situation gives distinct hope that it will at any rate be possible, if the present policy can be pursued during the whole course of the outbreak, to prevent any further large conflagration such as that which has occurred in Cheshire.

Up to and including the 21st January, the total number of outbreaks since the present epidemic started on the 27th August last is 2,403. The numbers of animals slaughtered, or authorised to be slaughtered, are—Cattle, 82,147; sheep, 28,056; pigs, 38,143. These figures represent a percentage of 1.1 in the case of cattle, 0.14 per cent. in the case of sheep, and 1.4 per cent. in the case of pigs, of the total number of animals in each category in Great Britain. The estimated gross compensation payable for slaughtered animals up to that date was £2,524,000, of which about £325,000 is expected to be returned from the salvage of healthy carcasses.

An addition to the exception to the general policy of slaughter made in the case of pedigree herds has been adopted. It concerns the dairy stock in certain badly stricken areas of Cheshire which are on farms where the buildings and surroundings are such as, in the Ministry's view, make it possible to isolate without danger to other stock, or to the ultimate success of the stamping-out policy. The Ministry is prepared in these cases to adopt isolation in the same way as it has been adopted in suitable cases where pedigree stock are concerned. It will be understood that the Ministry must be the judge of what cases are suitable for isolation in the districts of Cheshire in which this concession will be operative, and that where the Ministry prescribes isolation there will be no compensation paid for losses which may be sustained. This alteration does not constitute any departure from the stamping-out policy, or a reversion to a policy of isolation. The Ministry is more than ever convinced that the principle of slaughter is the only policy which can safely be adopted in the generality of cases where foot-and-mouth disease is discovered.

TURNIPS, SWEDES AND KOHL RABI FOR STOCK FEEDING.

J. B. BOND, M.Sc.,

Agricultural Organiser for Derbyshire.

History.—Turnips were apparently grown as a garden vegetable in this country long before they became a field crop. During the 16th and 17th centuries their adoption for field cultivation was advocated by writers, especially Sir Richard Weston, who had seen turnips grown extensively in Holland and Germany. At that time, however, most of the arable land in Britain was worked on the open field system, wherein each occupier held scattered strips unfenced from his neighbours' land and open to the live stock of the parish after corn harvest. With the extension of enclosures, turnip cultivation gradually spread during the 18th century, effecting in its progress a transformation in farming methods and imparting those characteristics which came to be regarded as the distinctive features of modern British agriculture. Swedish turnips were introduced in 1777; but it was not until about 1850 that this kind had largely displaced the softer sorts of turnip in such an important arable county as Lincolnshire. The Kohl rabi, formerly called the Hungarian turnip, was introduced into Britain about 1890.

Turnip husbandry as we now know it, including the practices of drilling, ridging, singling and horse hoeing, is little more than a century old in many parts of Britain. It reached its zenith about 50 years ago; since when, with the general decline in arable cultivation, the turnip acreage has steadily diminished. In Denmark, however, where turnip cultivation was learnt from Britain, the acreage under this crop has steadily increased during the same period.

Influence of the Turnip.—Lord Ernle in the preface to his *English Farming Past and Present*, says that the introduction of the field cultivation of turnips was as truly the parent of a social revolution as was the introduction of textile machinery. Previously arable land had been bare fallowed after every two corn crops. When turnips and clover were introduced in the rotation, food became available for the winter feeding of greater numbers of cattle and sheep; and fresh meat began to replace salt flesh in the human winter diet. The improvement in the quality of British live stock was also intimately connected with the extension of turnip cultivation.

The maintenance of greater numbers of sheep and cattle

improved the condition of the soil, with the result that the yield of corn was more than doubled. The substitution of bare fallowing by manuring, as the means of fertilising the soil, brought into cultivation light land, which, although unproductive under the corn and fallow rotation, was found to be very suitable for turnip husbandry. Large areas of light land in Norfolk, Lincolnshire and Northumberland, which had previously been waste, were so reclaimed during the last quarter of the 18th century. Lastly may be mentioned the fact that the need for better implements with which to clean and prepare the tilth for turnip sowing brought about an improvement in the farmer's tillage equipment.

Turnips and Sheep.—There are districts where arable farming is pursued with sheep as the main object and here turnips are specially required to provide winter food for the flock. The principal source of income in typical British arable farming is, however, corn crops. Where the soil is light and the rainfall low, it is considered necessary to fold sheep on the land to bring it into the firm and enriched condition requisite for the production of good yields of grain. The turnip crop provides part of the food necessary for winter folding, while its cultivation affords an opportunity for cleaning the land, without the loss of organic matter associated with bare fallowing: light dry land is very dependent on the liberal addition of organic matter.

It is under such conditions as the above that turnip husbandry is most extensively practised—in the sheep and corn districts of Norfolk, Lincolnshire, Notts, Yorkshire, Durham, Northumberland, Suffolk, Hampshire and Dorset. The climatic conditions in these counties are not so favourable to the growth of turnips as in the moist western counties, where much heavier yields per acre are obtained; the greatest areas of turnips are grown, however, where there is the largest acreage of corn, where the roots are required for sheep feeding, and where the crop may be folded on the field in winter without harm but with benefit to the land.

Turnips alone are not an ideal or even a good ration for sheep. Sheep are adapted for dry conditions and for a ration in which the proportion of dry matter to water is about 1:3. In roots there is one part of dry substance to about nine parts of water; hence sheep on turnips should have a liberal allowance of dry fodder. Experiments indicate that the best quantity of roots to feed per week is about the weight of the sheep. The consumption of excessive quantities of roots is best checked by the

provision of sufficient dry fodder, especially clover hay: almost as much dry matter in the form of hay and concentrates should be fed as the sheep receives in its ration of roots. When transferring sheep from grass (which has a dry matter to water ratio of about 1 : 3½) to soft turnips (1 : 10) the provision of dry fodder is specially necessary.

Typically, a weekly ration of 100 lb. of swedes is accompanied by an allowance of 5 lb. of hay and 5 lb. of cake and corn. Although the nutriment in roots and hay is mainly carbohydrate matter, the supplementary concentrated food given to sheep being fattened on turnips need not be high in protein; in fact the feeding of too liberal an allowance of protein is dangerous to sheep.

In some districts it is not customary to pit or even to lift and cut roots for sheep; and, as regards the softer kinds of turnip fed before Christmas, pitting and cutting are not of great advantage. With swedes, however, which begin to be folded about the time when hogs are undergoing dental changes, fingerling is desirable. Further, when the roots are lifted and cut, the crop is consumed with less loss and waste, and the practice avoids the troubles caused by the excessive consumption of grit associated with the gnawing of dirty shells. In recent years, there has not been sufficient frost to cause much trouble through the feeding of frozen turnips; but it is considered good practice always to have sufficient roots lifted and stored to carry the flock through any ordinary period during which the roots and ground might be frost bound.

Turnips and Cattle Feeding.—The production of corn under a permanent system of agriculture necessitates converting the straw into manure to maintain the condition of the soil, especially its humus content. The ordinary method of effecting this conversion is to fatten cattle indoors in winter on roots and concentrates together with as much straw as they can eat and tread down. Typically about half the turnip crop grown on the farm is thus carted to the steading and utilised for cattle feeding, the other half being fed to sheep on the land. Where, as on the heavier soils, the proportion of straw crops to roots is commonly 8 to 1, a greater proportion, even to the whole of the root crop, is fed in the cattle yards.

The quantity of turnips in the daily ration of fattening cattle varies, according to the supply of roots available, between 40 and 120 lb. per head. As to what is the best allowance for fattening purposes, experiments suggest that about ¾ cwt. per head per day may be recommended for the ordinary 2½ years

old cattle used in winter feeding practice. This ration is also a convenient one for the typical feeding farm; the root crop yielding 15 tons per acre and the straw $1\frac{1}{4}$ tons, and with 3 acres of straw per acre of roots, the daily allowance of straw for food and litter may be 22 lb. and that of the roots 88 lb. per head. Where the proportion of roots to straw crops is 1 : 2 and half of the roots are fed on with sheep, the above-stated allowance of 22 lb. of straw per day would be accompanied by a ration of 66 lb. of roots.

As regards the method of feeding roots to the older fattening cattle, Scotch practice is largely in favour of giving the roots whole and the straw unchaffed. In England, however, many feeders pulp the roots and mix with the pulp a considerable quantity of straw chaff and part or the whole of the concentrates. Although the latter practice is often recommended, there is reason to believe that the foods are better masticated and ruminated if fed with less preparation. In an experiment at Garforth in 1903-4, bullocks fed with sliced swedes and yellow turnips gained 2.07 lb. per head per day as compared with a gain of 1.64 by a similar lot which received the same quantities of roots, straw and concentrates—but with the roots pulped and mixed with the chaff and meals. Similar results have been observed in practice with dairy cows.

The “corn and horn” farmer grows roots for the main reason that his land requires a thorough working and cleaning once every four or five years; the root crop, especially turnips, allows of this while producing a return in food material to cover part or the whole of the cost of its cultivation. The returns from winter fattening of cattle are, however, commonly so small that farmers do not as a rule devote land primarily to the production of fattening material. The root crop is, therefore, restricted to the area entitled to be cleaned in the proper course of rotation rather than extended at the expense of other crops.

Under conditions that are not favourable to the safe and cheap production of good turnip crops, arable farmers are constantly seeking ways of avoiding the necessity for growing roots. Four such methods have been tried: 1. Farming without cattle, the straw being sold off and the loss in manurial constituents being compensated by the return to the farm of artificials and town manure. 2. Converting the straw into artificial yard manure. 3. Cattle feeding without roots, their place being taken by additional concentrates, of which treacle is one. 4. Substituting the root crop with a crop of tares for hay or ensilage and cleaning the land by bastard following after harvesting the tares.

Turnips and Cattle Rearing.—McCombie, of Tillyfour, wrote: "I make it an almost universal rule (and I have never departed from the rule except with a loss), that I will graze no cattle except those that have been kept in the open straw-yard, and have been fed exclusively on turnips and straw. If you can get them off yellow turnips it will be decidedly to your advantage." As regards the comparative merits of chemically equivalent weights of swedes and yellow turnips, experiments at and in connection with Cockle Park in 1911-13 showed that two-year old shorthorns made smaller gains in winter but much more rapid progress in summer after wintering on a ration that included yellow turnips instead of swedes. Yearling blue-greys, however, gave the opposite results.

Experiments were carried out at Cockle Park to compare the immediate and after-effects of three methods of wintering and feeding yearling blue-grey cattle. Each lot received in winter a basal ration of 6 lb. hay and 1½ lb. soya cake, but in addition Lot 1, wintering out, had (in 1911-12) 2 lb. maize meal and 2½ lb. straw, or (1912-13) 1 lb. cotton cake and 3 lb. hay; Lots 2 and 3 received 25 lb. swedes or 33½ lb. yellow turnips respectively, and were housed at night. The weekly gains in lb. per head were as follows:—

<i>Year.</i>	<i>Feeding.</i>	<i>Winter.</i>	<i>Spring.</i>	<i>Summer.</i>	<i>Average.</i>
1911-12.					
	Lot 1. (root substitute)	10.0	2.2	13.4	10.3
	" 2. Swedes	8.0	4.0	15.6	10.5
	" 3. Yellow Turnips	8.4	2.4	14.9	10.2
1912-13.					
	Lot 1. (root substitute)	1.86	1.86	15.25	6.73
	" 2. Swedes	6.30	5.87	15.0	9.22
	" 3. Yellow Turnips	6.62	3.33	13.75	8.42

Turnips and Dairy Farming.—The most thorough investigation of the importance of roots in the production of milk has been made in Denmark. Commencing in 1884 with pigs, and in 1887 extending his feeding trials to dairy cows, Fjord obtained results that completely changed the Danish farmers' attitude towards root crops. The acreage under turnips, swedes and mangolds in Denmark was 95,000 in 1888, but by 1919 it had increased to 678,000; and Fjord's advice to grow a statute acre of roots for every three adult animals in the herd has been adopted as standard practice.

Fjord's feeding trials showed "that roots had a very considerable value; that roots could replace corn and oil cake in the food of both cows and pigs without changing their growth or the production of milk: that the addition of roots to the food

increased the milk yield of cows and made them lay on flesh at the same time; and that the larger yield of milk produced by giving roots was not caused by a greater proportion of water in the milk, but that the larger yield was of milk of the same richness as the milk produced without roots that 1 lb. of dry matter in roots has the same feeding value as 1 lb. of corn and that the dry matter in mangolds and swedes had the same feeding value, pound for pound, when fed to milch cows" (Faber: *Forage Crops in Denmark*).

In three experiments with cows at Bangour, Edinburgh, Lauder and Fagan compared the effect on the yield and composition of milk caused by substituting 72 lb. of turnips for 6 lb. of protein-rich meals, in a normal ration of 40 lb. of turnips, 15 lb. of hay and 10 lb. of concentrates. Each lot of cows had 15 lb. of hay, but whereas Lot 2 had 10 lb. of concentrates and 40 lb. of roots, Lot 1 had only 4 lb. of meals with 112 lb. of roots. The meals fed varied and the heavy turnip ration each year contained about $\frac{1}{2}$ lb. less of digestible protein than the normal ration fed to Lot 2. For this reason it might have been expected that the turnip ration would produce rather less milk, as in fact it did; but, contrary to common expectation, the more watery turnip ration in each experiment produced the milk with the higher fat content. The experimenters suggest that "the easily digestible carbohydrates contained in the turnips are specially suitable for fat formation." The actual yields and fat percentages were as follows:—

Experiment.	Lot 1. Turnip ration.		Lot 2. Ordinary ration.	
	Total yield of milk. lb.	Average percentage of fat.	Total yield of milk. lb.	Average % fat.
I. (1909)				
10 cows per lot; 9 weeks	15,240	3.49	15,818	3.03
II. (1910-11)				
11 cows per lot; 8 weeks	13,920	3.55	14,069	3.35
III. (1911-12)				
9 cows per lot; 10 weeks	14,345	3.68	15,637	3.26

Turnip Plant.—One of the objections often urged against the feeding of turnips to dairy cows is that they taint the milk. Dunne, writing of Danish practice (this *Journal*, April, 1916, p. 58), remarks that "the risk of imparting a bad flavour to the butter, popularly called 'turnip flavour,' disappeared as soon as the pasteurisation of milk became general. Since the advent of pasteurisation, the use of swede turnips

as a food for dairy cows has been steadily extended in Denmark. . . . Every Danish dairyman is convinced that roots are an indispensable constituent of an economic ration for cows. . . . When roots can be added to the ration in liberal quantities the cost of the ration is reduced to the minimum, and a maximum profit is obtained." It is significant that in recent years little has been heard of the matter of "turnip flavour." This may be due to the wide extension of the pasteurisation process in the British whole-milk trade. Replies from some of the largest firms engaged in the milk trade, however, contain the opinion that pasteurisation does not completely eliminate the said flavour. The Dairy Manager of the Derby Co-operative Society, which retails about 4,000 gallons of milk per day, is of opinion that the aeration of the milk during its proper passage over the cooler is a means of eliminating "turnip taint." A Derbyshire farmer's wife, who has won many and important prizes with her butter, informed the writer that she had never had trouble with "turnip taint" since she introduced the cream separator, although she often had such difficulties in the old days of hand skimming.

Roots or Hay?—In some districts there is a tendency to rely too much on hay as the basis of the winter rations of dairy cows. A critical study of such rations and their results in comparison with those which include a good allowance of roots, shows that there are limits to the usefulness of hay in milk production. The feeding of large quantities of fibrous fodder taxes the digestive capacity and energy of the cow and reduces her yield. On fair pasture, a cow can extract the 15 lb. of starch equivalent required in the production of 8 gallons of milk by the consumption of 27 lb. of dry matter in pasture grass. But to extract the same quantity of nutriment from hay, she would have to consume 42 lb. of dry matter, the digestion and utilisation of which would obviously divert the energy of the beast from her main function of milk production. In a good dairy ration the starch equivalent per 100 lb. of dry matter is about the same as that in pasture grass, to obtain which proportions it is necessary to limit the allowance of dry fibrous fodder to 15 or 17 lb. and supply the rest of the nutriment in the form of concentrates or roots.

A good root crop produces about three times as much effective milk-producing matter as a good crop of hay, as the

following comparison (omitting tops and aftermath)
indicates :—

	<i>Digestible Protein.</i> <i>lb.</i>	<i>Starch Equivalent.</i> <i>lb.</i>	<i>Milk-producing capacity.</i> <i>gallons.</i>
Swedes, 20 tons	493	3,270	545
Meadow hay, 30 cwt.	181	1,035	173

Composition of Turnips.—The amount of dry substance per 100 lb. of roots, or the percentage of dry matter is, in kohlrabi about 12.5, in swedes about 11.5, in yellow turnips about 9.5, and in soft white turnips about 8.0. In each kind, however, a difference of 1 per cent. either above or below these figures may occur, the chief causes of variation being seasonal influences, variety, and size of roots. Turnips grown in Scotland do not show higher percentages of dry matter than English-grown roots.

The dry substance of turnips is somewhat similar in nutritive value to that in oats and other carbohydrate concentrates. The higher lime-content of swedes in particular, however, is noteworthy in view of the recent fuller recognition of the importance of sufficient lime in the diet of dairy cows. At Wisconsin it was found that cows fed on lime-poor rations generally aborted or brought weakly calves and that these troubles could be averted by correcting the deficiency. Lime salts are also believed to have a specific favourable action on the reproductive organs; but, whether this or the vitamin content of turnips is the cause, it appears to be the case that cows breed more regularly where the winter ration includes a proper allowance of roots instead of too much wet grains and concentrates.

The following table, compiled from figures published by Dr. Crowther and Professor Wood, will facilitate the comparison of turnips with other farm food stuffs:—

Food Stuff.	Per 100 lb. of the natural food stuff.		Per 100 lb. of the dry substance.		
	Moisture.	Dry Matter.	Digestible Protein.	Starch Equivalent.	Lime.
Oats	13.3	86.7	9.2	68.6	0.1
Swedes	88.5	11.5	9.6	63.5	0.9
Soft turnips	91.5	8.5	7.1	51.7	0.5
Kohlrabi	87.3	12.7	5.6	65.3	1.5
Mangolds	88.0	12.0	5.8	51.7	0.4
Pasture grass	80.0	20.0	12.5	56.0	2.0
Meadow hay	14.3	85.7	6.3	35.9	1.2

SUB-SOILING TRIALS IN ESSEX.

With the co-operation of the East Anglian Institute of Agriculture, Chelmsford, the Ministry laid down last winter and spring a series of sub-soiled plots upon which it is proposed to take observations for five years. A further series is about to be laid down in the Oxford district. As a result, it is hoped that a good deal will be learned of the effect of sub-soiling, about which very little is really known at present.

A general description of methods was given in this *Journal* in January, 1923,* which will serve as an introduction to the present note on the Essex trials. This note relates to one season's work only, and will not discuss the details either of the operation or the results to the soil and the crop: such a discussion must wait until much more work has been done and many more observations taken. But the practical results of the Essex trials, measured by the crops, have been so markedly and uniformly successful as to warrant the publication of the figures of crop yields, in order that farmers who have not already done so, may consider whether it is not worth while to experiment on a field or two.

A few words may be said as to the scale of the trial. There were eight fields used in all, with a total area of 66 acres. The trial plots in the winter of 1922 had an average area of 0.852 acre, and those for the spring of 1923, 0.777 acre. These fields were chosen because they offered representative soil conditions from comparatively light land to heavy clay, viz.:—Sand and Gravel, Brick Earth, Boulder Clay and London Clay. Potatoes were grown on two fields of Sand and Gravel, and one field of Boulder Clay. Wheat was grown on London Clay and barley on Brick Earth.

It should be explained that the fields were divided into strips, that the control plots (which were ploughed and not sub-soiled) were situated between the sub-soiled plots, and that subsequent to ploughing and sub-soiling, each plot on the same field received identical treatment. It sometimes proved impossible to harvest the whole of each trial plot separately, and in such cases, sample plots were taken at regular intervals, and from the yield so obtained the total yield of the whole plot was calculated.

It will be seen that there are two types of tables for each crop. The first is for the un-sub-soiled plot which has a final

* Preliminary Report of a Trial of Sub-soiling Devices at Tonbridge, Jan., 1923, p. 911.

column giving the average value of the crop. The second is for the sub-soiled plot which has a final column giving the value of the increased or decreased yield due to the sub-soiling; an example of this is shown in table I for Kerr's Pink Potatoes. The average value of the potatoes per acre for the control plot is £25 19s. 2d., whilst the average value of the increased yield for the sub-soiled plot amounts to £7 4s. 9d. per acre.

Table I.—Kerr's Pink Potatoes.—Fields A and B were situated approximately 12 miles apart, and were sub-soiled in the winter of 1922 and spring of 1923 respectively. It will be seen that in field A sub-soiling at a depth of 7 in. produced the best results, but in field B sub-soiling at 5 in. was most remunerative. For Boulder Clay 9-in. sub-soiling proved best. There was a smaller proportion of chits to ware on all the sub-soiled as against the control plots, and in all cases, sub-soiling produced an increased yield. The effect therefore of sub-soiling was clearly to accelerate maturity—a point which will be kept under observation.

Table II.—King Edward Potatoes.—King Edward potatoes were grown on a portion of the sand and gravel fields A and B referred to in the previous table. The results agree with those obtained for Kerr's Pink potatoes, and show that for field A 7-in. sub-soiling, and field B 5-in. sub-soiling, produced the best results. An extremely small proportion of chits to ware was obtained on both fields.

Table III.—King George Potatoes on Boulder Clay.—The yield of potatoes is small by comparison with other fields, but this is probably due to the extremely dry condition of the soil when the potatoes were planted. The sub-soiled plots, however, show an increase in every case over the control plots. It will be seen that no great difference in the additional yield was shown between the sections sub-soiled at different depths.

Table IV.—Barley on Brick Earth.—The barley referred to in this table was sown very late, and only 16 weeks elapsed before harvesting. In this case sub-soiling at 9 in. produced the greatest additional yield.

Table V.—Wheat on London Clay.—The whole of the field of London Clay to which the figures relate was mole drained, and a portion sub-soiled by steam tackle. The crops from the sub-soiled and un-sub-soiled parts of the field were harvested and thrashed separately.

COSTS, YIELDS AND VALUES, ALL PER ACRE.

TABLE 1.
POTATOES. KERR'S PINK.

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.		Value.			
			Ware.	Chats.	£	s.	d.	
Sand and Gravel (A)	5	s. 10 d. 4	Tons. 4.18	Tons. .725	24	8	9	
Sand and Gravel (B)	5	s. 10 d. 4	7.15	1.6	42	10	6	
Boulder Clay	5	s. 14 d. 2	1.81	.48	10	18	8	
Average	5	s. 11 d. 7	4.38	.935	26	19	2	

(b) Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Gain or Loss (—) in Yields.		Gain or Loss.		
			Wares.	Chats.	Weight.		Value.
					Ware.	Chats.	
	Inches.	s. d.	Tons.	Tons.	per cent.	per cent.	£ s. d.
Sand and Gravel (A) ...	5	6 3	2.69	.141	64.83	19.44	15 1 6
Sand and Gravel (B) ...	5	5 9	2.28	.05	81.19	3.12	12 7 8
Boulder Clay ...	5	4 0	1.07	— .063	59.11	— 13.12	5 15 2
Average ...	5	5 7	1.999	.043	51.54	3.14	11 1 2
Sand and Gravel (A) ...	7	5 5	1.49	— .006	35.64	— .69	8 3 9
Sand and Gravel (B) ...	7	7 2	3.73	— .25	52.16	— 15.62	20 0 3
Boulder Clay ...	7	5 1	.98	— .104	54.14	— 21.66	5 3 7
Average ...	7	5 11	2.07	— .12	47.21	— 17.66	11 2 6
Sand and Gravel (A) ...	9	10 2	.265	— .265	6.84	— 35.17	0 19 6
Sand and Gravel (B) ...	9	7 4	2.9	— .14	40.59	— 15.62	15 1 0
Boulder Clay ...	9	6 3	.91	— .007	50.27	— 1.46	4 19 10
Average ...	9	7 11	1.36	— .134	32.39	— 14.37	7 4 9

TABLE 2.
KING EDWARD.
POTATOES.

(a) Control Plots.				Yield.		Value.	
Soil.	Depth of Ploughing.	Cost of Ploughing.		Ware.	Chats.	£ s. d.	
	Inches.	s. d.		Tons.	Tons.		
Sand and Gravel (A) ...	6	10 4		8.59	1.02	38 7 6	
Sand and Gravel (B) ...	6	10 4		6.75	1.28	46 8 8	

(b) Sub-solled Plots.				Difference in Yield.		Gain.	
Soil.	Depth of Sub-solling.	Extra Cost of Sub-solling.		Ware.	Chats.	Weight.	Value.
	Inches.	s. d.		Tons.	Tons.	per cent.	£ s. d.
Sand and Gravel (A) ...	5	5 9		3.14	.06	56.1	20 10 2
Sand and Gravel (B) ...	5	5 9		1.03	.36	15.2	7 8 4
Average ...	5	6 0		2.085	+ .205	35.65	13 19 3
Sand and Gravel (A) ...	7	5 5		2.03	— .185	36.3	12 16 6
Sand and Gravel (B) ...	7	7 2		4.33	— .06	64.1	28 5 4
Average ...	7	6 3		3.18	— .062	50.2	20 10 11
Sand and Gravel (A) ...	9	10 2		.525	— .14	9.3	3 2 8
Sand and Gravel (B) ...	9	7 4		1.68	— .01	24.3	10 18 0
Average ...	9	8 9		1.102	— .065	17.05	7 0 4

TABLE 3.
POTATOES. KING GEORGE.

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.		Value.
			Ware.	Chats.	
Boulder Clay	Inches. 5	s. d. 14 2	Tons. 2.34	Tons. .36	£. s. d. 13 11 9

(b) Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.		Gain.		
			Ware.	Chats.	Weight.		Value.
					Ware.	Chats.	
Boulder Clay ...	Inches. 5	s. d. 4 9	Tons. 1.86	Tons. .07	per cent. 58.12	per cent. 19.41	£ s. d. 7 12 5
Boulder Clay ...	7	5 1	1.29	.143	55.12	39.72	7 7 8
Boulder Clay ...	9	6 3	1.30	.12	55.55	33.33	7 7 10

TABLE 4.
BARLEY.

(a) Control Plots.		Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.	Value.
	
Brick Earth	lb.	£ s. d.
			6	8 1	1,174	4 14 4

(b) Sub-soiled Plots.		Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.	Gain.
			Inches.	£ s. d.	lb.	£ s. d.
Brick Earth	5	3 3	990	0 17 8
Brick Earth	7	3 0	244	0 19 8
Brick Earth	9	6 3	343	1 8 0.

TABLE 5.
WHEAT.

(a) Control Plots.		Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.	Value.
	
London Clay	Bushels.	£ s. d.
			6	1 11 1	4486	12 5 5

(b) Sub-soiled Plots.		Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.	Gain.
			Inches.	£ s. d.	Bushels.	£ s. d.
London Clay	7	13 11	11 64	3 4 5
					26.2	

General Results.—The tables show that in the first year every sub-soiled plot produced an increased yield, the value of which was greater than the extra cost of sub-soiling over ploughing. A recent examination of the various plots suggested that the effects of sub-soiling will last for some further considerable time.

The figures indicate that the best depth of sub-soiling may vary from field to field even in the case of soil apparently similar in character. This is a point which is receiving investigation, but the results certainly suggest that any farmer who proposes to practise sub-soiling, would be well advised to experiment at different depths for the first year and determine by the results obtained the most profitable depth for his own particular conditions.

CO-OPERATIVE MARKETING OF MILK IN THE UNITED STATES.

THE distribution of milk has always been one of the most difficult problems of organisation which agriculturists have to face. It is one towards the more satisfactory solution of which great efforts have been made in the United States during recent years.

The difference between producers' and consumers' prices, and the high cost of distribution, are points which are well known to characterize the milk trade in this country. A very full analysis of the causes leading to this state of affairs is given in the Interim Report on Milk and Milk Products of the Lidlithgow Committee.* In the United States no less than in this country have the characteristics referred to been the general rule. The milk middlemen in America absorb a very large proportion of the consumers' price. It has been said that on the average of the available data for 1920-1922, the distributor gets more than 60 per cent., the producer less than 32 per cent., while transport costs absorb about 8 per cent. of the consumers' price.

The milk distribution trade in the United States has long been well established and financially powerful, and it is hardly a surprise that the progress of co-operative milk marketing has been marked by many violent struggles with the existing privately owned distributive undertakings. The first stages in the development of the co-operative movement have been almost

* Cmd. 1854, price 3s. net, 3s. 1½d. post free. Obtainable from H.M. Stationery Office, Kingsway, W.C.2

exclusively confined to the formation of producers' collective bargaining associations. Such associations did not, however, meet with unqualified success. A bargaining association which sold its milk to private dealers seldom found it easy to conduct business without creating hostility amongst the distributors. Moreover, they did nothing to overcome the real economic wastefulness of the existing system.

Nevertheless, much of the initial work of organising co-operative milk marketing was done by these associations. Between 1887 and 1889 there was a very rapid development of the movement amongst farmers towards the formation of associations for the collective sale of milk, and a further impetus was given to it during the last decade of the 19th century. Most of these organisations actually came into being to "fight the Milk Trusts" which operated in the principal cities of the United States, and their early efforts were frequently accompanied by violent disputes, "Milk strikes," and other disturbances.

As in most other branches of agriculture in America, by far the most widespread movement in co-operative milk marketing occurred during and after the War. In the neighbourhood of nearly all the large cities of the United States which have a population of 200,000 or over, co-operative milk selling associations were formed by local producers during the years 1915-1919. They were very different in form and in the objects at which they aimed, from the co-operative marketing organisations which have been developed in the orange trade in California, in the dried fruit trade, in the tobacco industry, and other branches of agriculture. They still consisted primarily of bargaining associations, which fixed prices by the system of meeting the distributors, and attempting to come to an agreement. No attempts were made at these early stages to control the market on the lines of the Californian Fruit Growers, or to carry out the final stages of distribution under the direct control of the co-operative organisation. Their success was the kind of success that generally attends collective, as contrasted with individual bargaining. They did in fact obtain a better price for milk for the individual producer than he had been able to secure by his own unaided efforts, but not without serious opposition from private interests. Like other organisations for collective bargaining, their ultimate weapon was to strike, and some sensational milk strikes of this character actually occurred during the war period in Chicago, Boston and New York.

(1).—An example of this type of organisation is afforded by the Twin City Milk Producers' Association, which was founded in 1916. In its early stages it was successful in obtaining for its members a definitely higher price for milk than generally prevailed in neighbouring unorganised districts; but it was soon recognised that the plan of collecting bargaining only went a small distance in solving the problem, and in December, 1919, a Stock Co-operative Society was formed with a capital of \$500,000 to provide plants to manufacture the surplus milk into various milk products. At the present time the Association has 4,200 members, most of whose dairies are within 40 miles of two cities, St. Paul and Minneapolis. It handles 80 per cent. of the milk of the district. The organisation embodies the usual principle of long term contracts under which all its members are bound to deliver their production of milk and cream, other than home requirements, to the Association. The milk is delivered each morning to a Receiving Station or plant of the Association, the amount needed by dealers being usually specified by means of contracts with the Association to take a stated amount of milk daily. A small surplus is retained for emergencies, and the balance remains at the country plants and is manufactured into cheese, butter, and other milk products.

This Association within its limited sphere has made very considerable progress. In 1921 it handled approximately 14 million gallons of milk, of which over 9 million gallons were sold to distributors, the bulk of the remainder being manufactured. Although the Twin City Milk Producers' Association confined its activities within the sphere indicated above, indirectly it led to the development of a further stage towards the co-operative control of distribution. The milk "drivers" of Minneapolis organised the Franklin Co-operative Creamery Association, to carry out the distribution of the milk from the Producers' Association, and to operate in conjunction with it. After starting with only 18 delivery wagons, by the spring of 1921 it had grown to 180 wagons delivering in all approximately 50 per cent. of the milk supplies of Minneapolis.

(2).—The most important co-operative milk marketing organisation in the United States is the Dairymen's League Co-operative Association (Inc.) of New York, one of the largest co-operative enterprises in America. It was organised in 1921, and during the first year of its existence, handled about 250 million gallons of milk, in return for which it distributed some \$2,000,000 dollars amongst its members, who number approximately 65,000. At the end of March, 1922, the Association was

operating 128 manufacturing plants, and its members were organised at 944 receiving stations. During the latter year, the turnover of the Association amounted to approximately 6,000,000 dollars per month.

The Dairymen's League Co-operative Association succeeded an organisation known as the Dairymen's League, which was inaugurated as far back as 1907, primarily as a producers' protective association. In 1916, the latter body came into conflict with the New York Distributors, and after a short but severe struggle, succeeded in establishing working arrangements for its produce. Between that year and 1921, the Dairymen's League Co-operative Association (Inc.) began to handle the milk of more than 50,000 farmers under contracts which enable it to pool all its members' milk produced for market. The Association was empowered to dispose of the milk to distributors or to manufacturers of butter, condensed milk, cheese, ice cream, etc., or to manufacture it in plants owned by the Association. The producers at each of the 944 established points are organised into local corporations, existing primarily for the purpose of facilitating co-operative purchases of feeding stuffs and supplies, and for representation purposes in the Association.

The Association, like many similar co-operative undertakings in the United States, is a non-stock organisation, which is incorporated under the Co-operative Laws of New York providing for marketing associations formed on this plan. It is governed by 24 directors, each of whom represents a district.

The existence of farmer-owned milk depots, operated by experts in the employ of the Association, insures that there is no artificial interference with, or closing down of, the plant, as long as the farmers have milk to sell. It means that surplus milk is manufactured into the more advantageous forms of milk products, and is not shipped to the cities, as in former days, to force down the price of fluid milk received by the producer. The effect is that the milk market is stabilised to a greater degree, and in consequence a better price is assured to the farmer.

The Association returns to its members all the proceeds from the sale of milk, less the expenses for administration, and deductions for new plants and working capital. Each member receives the same base price per 100 lb. of milk, but with differentials for freight, butter fat, and hygienic quality, by means of 12 monthly milk cheques. Whatever is left as a residue of the year's business, goes to the members in a thirteenth cheque. The method of financing the Association, is to take certain

amounts, each month from the returns to producers, and to issue interest-bearing certificates of indebtedness due in 5 years. During the first 11 months of the Association's life more than 5,000,000 dollars were thus retained, to be used by the Association for the purchase and equipment of plant, etc.

(3).—A third example of a similar organisation is the New England Milk Producers Association, a non-stock organisation incorporated under the laws of Massachusetts. Its general structure is not unlike that of the Dairymen's League Co-operative Association (Inc.). Primarily it is a bargaining association. It has, however, one or two distinctive features. The problem of surplus milk is handled according to a plan devised by the Federal Milk Commission during the War—a plan which has been continued since that time by agreement between the producers and dealers. In effect, this arrangement leaves the surplus milk to be handled by the dealers, the price paid by the dealers depending on the use to which it is put. The Association and the dealers, in the first instance, come to terms as regards the price which is to be paid for the milk used in the regular trade. The price of milk used for other purposes is determined by other factors which have to be agreed upon. The dealers report to a disinterested party each month, indicating the amount of milk which is produced and the amount of by-products made. This party—at present the Commissioner of Agriculture—computes, in accordance with an approved system, the amount of milk represented in by-products, and the price; the remainder represents the milk used in the whole milk trade, and for which the price which had been arranged by the Association and dealers, is paid.

(4).—An instance of a more advanced development on co-operative lines is afforded by the combined enterprise of the Frazer Valley Milk Producers Association, and the Frazer Valley Dairies, Ltd. The former comprises 1,800 dairymen, whose farms are situated in the valley of the Frazer River, and supply milk to Vancouver. The Association, which has a capital of 750,000 dollars, and deals with 90 per cent. of the milk in this district, receives the milk from its members under continuous contracts, which can only be revoked after one year's written notice. About one-fifth of its capital is used to finance the construction and equipment of condenseries, creameries and cheese plants handling the milk which is not supplied direct to Vancouver; a "surplus" plant situated in Vancouver deals with the seasonal fluctuation in the Association's milk supplies,

while the remainder of its capital is used in the subsidiary organisation, the Frazer Valley Dairies, Ltd. The Association sells its fluid milk both to the latter and to some other distributors, the Frazer Valley Dairies, Ltd. buying its milk from the Association at prices fixed by the latter. It distributes 65 per cent. of the Vancouver milk, and returns the bulk of its profit to the parent Association. It has been stated that the costs of this distributive organisation have been very low, and the result of the combined arrangement has been to ensure to the milk producers a substantially larger proportion of the consumers' price than had previously been the case.

Note.—It is perhaps not without interest to compare the progress made in co-operative milk marketing in the United States with other branches of the co-operative movement, a short account of which was given in the January issue of this *Journal*. It is easy to see that in the case of milk one of the chief problems still remains unsolved. Co-operation has done little to gain control over the retail distribution of fluid milk in the towns, or to reduce the cost of this service. One of the difficulties in the development of the retail side of the business is not far to seek: the capital required for distribution in large cities is very great, and the characteristic of American co-operative enterprise is that it is usually operated on very little capital, the non-stock non-profit association being the common type. A second difficulty is the highly organised state of the existing retail business and the high degree of technical skill required in its management. Nevertheless, many authorities consider that the co-operative sale of milk by farmers and its retail distribution by ordinary dealers is not a satisfactory combination, and it seems probable that the next few years will see the development of co-operative enterprise in retail milk distribution in the United States.

EARLY ESTIMATES OF GRAIN GROWING IN GREAT BRITAIN.

Persons interested in the history of British Agriculture often wish to obtain some early statistics of the acreage and production of crops in this country before such statistics were officially collected in 1866-67. The following note gives such information on this subject as is available.

The most detailed estimate of the distribution of agricultural land in England available at the beginning of the 19th century was one made about 1771 by Arthur Young in his "Tour

through the East of England." No great value can, however, be attached to his figures as they were based on the mistaken assumption that the total area of England and Wales amounted to about 47 million acres, whereas more correct measurements subsequently showed an extent of only 37,824,000 acres. As, however, he is the only writer of the period who attempted to estimate the production of grain, the figures have some interest as showing his opinion of the supplies available at that time from home sources. The figures are as follows:—

ENGLAND.			
	Area.		Production.
	Acres.		Quarters.
Wheat	...	2,795,008	8,385,024
Barley	...	2,623,885	10,495,540
Oats...	...	1,483,065	7,044,558
Peas	...	513,369	1,475,935
Beans	...	399,287	1,647,058

In 1797 Mr. Middleton, in a Report on the State of Agriculture in Middlesex prepared for the old Board of Agriculture, made an estimate of the proportion of each 10 million acres of arable land occupied by the different crops, founded, he says, "on my own observations in most of the counties of England." He followed, however, Arthur Young in calculating the total area of England and Wales at 47 million acres and placed the arable acreage at 15 millions. Dr. Beeke in 1800 (*Observations on the Produce of the Income Tax*), taking the total area at 98,500,000 acres, reduced Middleton's arable estimate proportionately to 11,491,000 acres; and Mr. W. T. Comber in *An Enquiry into the State of National Subsistence* (1808) seems to have applied Middleton's proportionate figures to this area and arrived at the following result:—

	Acres.
Wheat	3,160,000
Oats and Beans	2,872,000
Barley and Rye	861,000

McCulloch in the edition of his *Statistical Account of the British Empire* published in 1837 gives figures of the average yield per acre of the undermentioned crops, deduced from the county surveys of the old Board of Agriculture made between 1799 and 1815. These may be compared with Arthur Young's estimate adopted in the table of production given above:—

	Board of Agriculture Surveys.	Arthur Young's estimate, 1771.
	Bushels per acre.	Bushels per acre.
Wheat	21	24
Barley	32½	32
Oats...	35½	38
Rye	23½	—
Peas	28	23
Beans	26½	53

Applying the Board's figures to Mr. Comber's estimate of the wheat acreage the production of that crop at about the beginning of the nineteenth century would seem to have been about 8,400,000 quarters.

In the case of Scotland, an estimate of the area under cultivation was made in the General Report on Scotland published by the Board of Agriculture in 1814. No figures were given of production, but the area of the principal crops was as follows:—

	Acres.
Wheat	140,095
Barley	280,193
Oats	1,260,362
Rye	500
Beans and Peas	118,000
Potatoes	80,000

If the wheat yield of Scotland is taken at the same figure as England, viz., 21 bushels per acre, the production of wheat in Scotland would be 968,000 quarters, making a total for Great Britain of 8,768,000 quarters. This may be compared with the statement of Tooke, in his *History of Prices*, that the produce of an ordinary crop of wheat in this country at the beginning of the last century was estimated at nearly 9 million quarters.

In 1814, however, Arthur Young in giving evidence before the Select Committee on Petitions relating to the Corn Laws made an estimate on a rather different basis, and gave a figure for the production or consumption of wheat, barley and oats in the United Kingdom. His calculation was as follows:

ENGLAND AND WALES:		Qr.
Out of a population of 10,791,000, 8,500,000 persons consumed		
wheat as bread at the rate of one quarter per annum ...	8,500,000	
Consumption not as bread	100,000	
	8,600,000	
Less net imports (average of 1811—1812)	187,162	
	8,412,838	
Add for seed, one-ninth	934,739	
	9,347,577	
Annual growth=3,399,126 acres at 22 bushels per acre		
Barley and oats, occupying half as much land again		
as wheat, would represent 5,098,689 acres at 36 bushels	22,941,109	
SCOTLAND:		
Wheat (? barley) and oats (consumption)	5,401,283	
IRELAND:		
Wheat (? barley) and oats (consumption)	3,375,000	
Total production of wheat, barley and oats in the		
United Kingdom	41,067,980	

"Oats," he observes, "are much consumed in Scotland, the amount in quarters much exceeding the consumption of wheat per head." In regard to Ireland, the basis for the support

of the population was the potato, and he allows 18 bushels per head of wheat and oats for 1½ million persons as representing the total consumption of a population of 5 millions.

The importance of wheat as the principal food stuff of this country, and its extremely high price in some of the years between 1800 and 1815, caused great attention to be given to facts relating to its cultivation and importation, but it does not appear that up to the year 1816 any attempt was made at a quantitative annual estimate of the amount available to meet the requirements of the population. As late as 1821 the Select Committee on the State of Agriculture assumed "what they believed to be then true," that the annual produce of corn, the growth of the United Kingdom, was upon an average crop about equal to the annual consumption.

Subsequently in 1828 an estimate was made by Mr. Jacob, Inspector-General of Corn Returns, in his Second Report, made to the Board of Trade, on Agriculture and the Trade in Corn in Northern Europe, 1828. He put the annual consumption in Great Britain, exclusive of seed, at 12,000,000 qr. and estimated the quantity of the produce according to a scale "based upon extensive inquiries." He also at the same time made an estimate of the supply and demand for the years 1816 to 1827, which it may be interesting to reproduce:—

Year.	In thousands of qr.						Price per qr. in Harvest year.
	Stock in hand.	Imports.	Produce.	Total available.	Estimated requirements for food and seed.	Stock remain- ing in Hand.	
1816	6,150	772	9,000	15,922	12,480	3,442	s. d. 97 10
1817	3,442	1,739	11,700	13,881	12,670	4,211	84 6
1818	4,211	733	12,000	16,944	12,850	4,094	78 5
1819	4,094	408	12,500	16,997	13,030	3,967	68 5
1820	3,967	567	16,900	20,534	13,210	7,324	57 0
1821	7,324	463	12,600	20,387	13,390	6,997	50 5
1822	6,997	400	13,500	20,897	13,570	7,327	46 4
1823	7,327	367	11,000	18,694	13,760	4,934	59 9
1824	4,934	411	11,500	16,856	13,900	2,956	64 6
1825	2,956	811	12,700	16,467	14,110	2,357	61 1
1826	2,357	701	13,000	16,058	14,290	1,768	56 1
1827	1,768	957	12,500	15,225	14,470	755	53 2

In regard to this statement Mr. Jacob observed: "No one can be more aware than myself of the errors to which an implicit confidence in the preceding table would lead. . . . It may, however, deserve a considerable degree of attention as a clue to the development of some important views. . . . The relative productiveness of the several years, being framed from as great a variety of facts as could be collected is not

likely to be very far from an accurate view. The statements relating to absolute quantities are certainly only unauthoritative conjectures. There are no satisfactory notices in this country of the number of acres destined to grow bread corn nor even of the number under arable cultivation. There are no means of forming any judgment of what the average acreable produce of wheat is. . . . It is equally difficult to determine what is the annual consumption; in the table it is estimated at somewhat more than 6 bushels and a half per person."

McCulloch in his Statistical Account of the British Empire (1854) gives an estimate for the year 1846, as follows:—

	England and Wales.			Scotland.	
	acres.	qr.		acres.	qr.
Wheat ...	3,800,000	15,200,000	...	350,000	1,225,000
Barley ...	1,500,000	6,375,000	...	450,000	1,800,000
Oats ...	2,500,000	12,500,000	...	1,300,000	6,500,000

About this period, the demand for statistical information as to production developed, and the apprehension of an impending famine in Ireland in 1847 led to the systematic collection in that country of returns both of acreage and produce. In 1853, and in several subsequent years the Board of Trade, at the suggestion of the Highland Society, attempted as an experiment the collection of agricultural statistics both in England and Scotland. An estimate was made in 1854 for the whole of England and Wales on the basis of reports obtained by Poor Law Inspectors from 11 counties. In the case of Scotland, complete returns seem to have been obtained in 1855, 1856 and 1857.

According to these estimates, the acreage of grain and potatoes in England and Wales in 1854 and in Scotland in 1855 was as follows:—

	England and Wales, (1854)			Scotland, (1855)	
	acres.	...		acres.	...
Wheat ...	3,808,000	...	...	191,000	...
Barley ...	2,668,000	...	...	186,000	...
Oats ...	1,308,000	...	...	934,000	...
Potatoes ...	192,000	...	...	147,000	...

Estimates were also made by Sir John Lawes as regards the wheat acreage and production of the United Kingdom from 1852-53 (see *Journal of the Royal Agric. Soc.*, 1893). In 1866, the official collection of statistics of the area of crops and number of live stock was commenced, but it was not till 1884 that this was supplemented by official estimates of production.

HOUSING OF CASUAL LABOUR.

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IN the issue of this *Journal* for July, 1919, there appeared a most interesting account of the starting and development of raspberry cultivation in the neighbourhood of Blairgowrie. The author of that article, Mr. J. M. Hodge, has since dealt with the whole subject in a still more comprehensive manner in "*Raspberry Growing in Scotland*."* This book contains a record of past achievement and a survey of future possibilities, and the whole position is reviewed from every standpoint—agricultural, economic and national. In the course of a recent visit to the raspberry growing districts of Perthshire, undertaken with the object of gaining some insight into the conditions under which Scottish fruit pickers live and work, much help was derived from Mr. Hodge's written narrative, in which adequate consideration is given to the problem of labour. The additional information furnished in person by Mr. Hodge and Mr. Keay (who has also had much to do with these fruit-growing enterprises), contributed materially to understanding of the present situation. Viewed in the light of past history, existing arrangements at Blairgowrie illustrate the continuous progress which has been made in the matter of accommodation for casual labour.

In endeavouring to give some brief description of the housing of such seasonal workers in Perthshire to-day it will be convenient to deal (1) with properties in individual ownership, and (2) with those in joint ownership.

Mr. Hodge's statement shows that raspberry growing, on a commercial scale, started in a small way at Blairgowrie in the closing years of the 19th century. At first the labour problem was practically non-existent, for the villages yielded a sufficient supply of pickers. As the area under fruit cultivation steadily increased, it became evident that it would be necessary to import labour for the harvest season, and the "housing question" became acute. It is related that one enterprising grower "erected corrugated iron buildings, fitted with wooden beds and supplied with straw and blankets. Others followed his example and the fields became dotted with more or less respectable sheds for the housing of the pickers." With some slight modification this would still apply to the provision for seasonal labour made

* Published by the Scottish Smallholders' Organisation, Ltd., 1921.

by the average individual grower in raspberry growing areas to-day, if establishments recently visited by the writer may be regarded as typical.

Accommodation Provided by the Smaller Growers.—

Camp I catered for a relatively small number of pickers and the accommodation was correspondingly limited in extent and character. The buildings, of corrugated iron, included mess-room, kitchen and sleeping huts. The latter contained wooden beds (fashioned on the lines of bunks), filled with loose straw and provided with army blankets, fumigated at the end of the season. Two persons slept in each bunk. Ablutions were performed in buckets with water from taps outside the huts. Earth sanitation was available. A good fire was kept burning in the kitchen stove, where the kettles were boiled. The messroom was small and bare, but as the camp was near Blairgowrie there was no difficulty about the purchase of provisions. An attendant exercised general superintendence over the camp. While primary needs were satisfied at this camp, it was felt that it represented the minimum of comfort and that the standards of order and cleanliness might, with advantage, have been higher.

Camp II instanced progressive improvement. More workers were located there, and the buildings, though resembling those of *Camp I*, were of greater capacity. The rooms were larger and lighter, and the general "lay out" more satisfactory. Sleeping accommodation took the form of large dormitories for single men and single women respectively and of separate compartments for families. These huts were also fitted with wooden beds of the usual box-like design, plentifully supplied with straw. Lockers, whose tops could be used as tables, were a new and useful feature of the furnishing. Sanitary provision for the men adjoined that for the women, but, by order of the local Sanitary Officer, entirely separate arrangements were to be made in the future.

Camp III, the property of a local landowner, proved to be the scene of a special experiment. Between 20 and 30 women students from Glasgow and Edinburgh, secure a cheap and pleasant holiday every year by undertaking the picking of fruit at this particular plantation. Excellent wooden buildings, with good floors and a plentiful supply of windows, have been erected for their reception. A large and pleasant room was in use as combined kitchen, pantry and messroom. The services of a cook are retained throughout the season and 12s. per week is

all that the pickers are called on to contribute in return for their comfortable quarters and good food. The spacious dormitory was lined, on either side, with a double row of bunks, and personal property was placed on a long narrow table or form, fixed in the middle of the hut. Connected with the hut was a bathroom containing lavatory basins and two baths, the hot water for which was fetched from the kitchen boiler. There were three w.c.'s. The camp as a whole was a very pleasant example of the satisfactory arrangements which can be made when a limited number of persons of a selected type are employed year after year.

At *Camp IV* a two-storeyed wooden building had been put up for the accommodation of a small number of special pickers (e.g., Girl Guides and others). In this case the ground floor was used for messroom, kitchen, etc., and the upper storey as a dormitory. Here again it was clear that temporary quarters can be made very comfortable indeed for a small and homogeneous body of pickers.

Adapted Farm Buildings.—In the foregoing instances the buildings had all been erected specially for housing purposes. An instructive visit was paid to a larger farm some miles from Blairgowrie, which may be described as *Camp V*. This exemplified the adaptation of ordinary farm buildings on a large scale and illustrated the special arrangements which remoteness of situation entails. While the floors of the older buildings were necessarily rough, the cleansing and whitewashing of walls had helped to produce a habitable atmosphere in places originally designed for very different uses. Space available in the lofts and ground-floor buildings already existing had been supplemented by a large hut of corrugated iron. The men's quarters were separated from those of the women. The usual type of wooden box-bed, raised well above the ground, was installed throughout the dormitories and completed by straw mattresses and blankets. Ablutions were performed in pails, and earth sanitation was arranged.

Two pleasing features of the encampment, which went far to alleviate the difficulties otherwise inseparable from an isolated situation, were the canteen provided by the owner and the recreation tent organised by the Church of Scotland. The former was a large room built of corrugated iron with concrete flooring and good lighting, which served as a combined kitchen and messroom. Such of the pickers as did not cater for themselves could buy cooked food (soup, potatoes, etc.), and eat it

there. A grocery store was also open in the canteen, and so everything essential to the pickers' housekeeping was obtainable on the premises. The large tent, furnished with forms, benches and piano, and provided with magazines, etc., was in charge of a neighbouring Minister of the Church of Scotland. Camp V stands out in memory as an example of the way in which ordinary farm premises may, with extensions, be utilised to meet the requirements of a new industry springing up on the land.

Larger Schemes of Accommodation.—*Essendy.*—Turning to conditions on lands in joint ownership, the first ambitious housing scheme on co-operative lines was inaugurated at Essendy, an estate some miles from Blairgowrie, in 1905. Appreciation of the fact that raspberries cannot be grown continuously on the same land has now resulted in temporary discontinuance of fruit culture at Essendy, and only a small proportion of the buildings there are in use at present. The scheme, however, remains, even in a state of partial disuse, an impressive contribution to the solution of the problem of housing casual labour. It is surprising that accommodation so extensive and of so excellent a type could have been erected at a cost which, even allowing for pre-war prices, was so inconsiderable. Between 1905 and 1908 the sum of £3,441 was disbursed for housing at Essendy—a comparatively small sum when the character and capacity of the settlement is taken into account.

Some re-distribution having been found necessary, the buildings are now grouped in two main portions in beautiful surroundings on a tract of moorland sloping down to Marlee Loch. The fruit fields are readily reached from one or other of these groups; such accessibility was indeed found to be essential to any satisfactory housing scheme. The accommodation comprises a large number of sleeping huts, each capable of holding 20 persons. All these huts are of substantial appearance, some being built of brick, others of corrugated iron. By judicious management, it proved possible to erect the former at a cost of £75, the latter at £50 per hut in pre-war days. At the end of each a small room or recess fitted with basins makes an admirable ablution room, and the shelter and privacy thus secured must be greatly appreciated. Earth sanitation is provided. The three spacious canteens, built of corrugated iron with excellent lighting and flooring, are greatly in advance of previous standards of accommodation for the agricultural worker.

When not required for meals, they are used as recreation rooms. The canteens are served by well-planned kitchens, equipped with suitable stoves and boilers and well provided with larder and storage space. The general arrangements are such as should secure quick and efficient service of meals. Grocery and stationery stores are maintained (though now on a diminishing scale) on the premises and regulated by a system of ticket distribution.

In the heyday of raspberry growing at Blairgowrie it is related that a matron and thirty servants attended to the material wants of the pickers, that a doctor, cleansing officer and a policeman ensured their health and safety, and that week-day concerts and religious services on Sunday ministered to recreation and spiritual welfare. "Add to these things," says Mr. Hodge, "that the settlement housed the pickers of all the growers on co-operative lines, each grower having a *pro indiviso* interest in the buildings in proportion to the acreage of ground he owned; that the pickers were secured not for the individual but for the associated growers and allocated among them according to their needs; and that the produce of the colony was sold by a salesman appointed for the purpose, and you have a scheme which as far as I know has no counterpart . . ." The visitor from England, contemplating the adequacy and attractiveness of the whole design at Essendy, appreciating the sound and sensible lines on which it has been carried out, and realising the good sense and vision, the regard for real efficiency and ultimate economy which prompted both conception and execution can only echo the regret that so satisfactory a scheme has not been more widely copied as yet in the south.

Aberuthven: The Latest Development.—At Aberuthven, in the Parish of Auchterarder, on the estate of the Hall Farming Company, it proved possible to see, under the guidance of Mr. Neil Young, the manager, what may be regarded as the latest example of Scottish schemes for housing such casual labour. Raspberry cultivation is at its height at Aberuthven and the activity there is comparable to that which existed in earlier times at Essendy. Experience gained at the latter place has proved of value in developing Aberuthven. It had become apparent that pickers must be near their work, and it was further understood from the outset that, as the amount of labour required would be large, workers of differing types would need to be considered. As a result there are eight housing centres on the 400 acres now under raspberries. At the time of this visit there

were over 1,000 pickers (chiefly coming from Glasgow) in residence, and it was expected that this number would be very considerably exceeded during the six weeks which constituted the season. Of the eight centres, three were allocated to industrial schools, four to women and children and one to men.

These eight camps at Aberuthven are all delightfully situated and are mostly specially built, though there is one case of adapted buildings (lofts, etc.). The usual building is of corrugated iron, with numerous windows and good wooden floors. The sleeping quarters consist of huts, equipped with 9 beds (of the wooden box variety), straw-filled mattresses and army blankets. Since each bed holds two people, 18 were housed in each hut, but the local Sanitary Officer is now limiting the residents to 12, in accordance with a bye-law which provides that accommodation erected in the future shall allow 300 cubic feet of air space per person.

Drying rooms are provided for the pickers' wet clothing. Ablutions are performed in pails with water obtained from adjacent taps or streams. Sanitary conveniences (on the pit system with use of disinfectants), are provided at each centre in the proportion of one to every twenty residents. There is a matron in charge at each camp, who is responsible for order, cleanliness and general discipline. Her own hut is part of the camp in question.

Each centre includes a canteen (capable of holding about 300 people), built of corrugated iron with a good floor, which is a feature of these Scottish housing schemes, and furnished with wooden tables and forms. Kitchens and store-rooms adjoin each canteen. Each kitchen also serves as combined pantry and scullery and is fitted with a concrete floor and equipped with kitchen stove, sink and everything necessary for culinary purposes. At each canteen there is a staff of one cook and 4 helpers and a clerk in charge of tickets, etc. Both meals and dry goods (bread, etc.), are sold on the ticket system. No special arrangements for recreation are now in force at Auchterarder, but a doctor visits the estate on three days of the week and can be fetched at any time by telephone.

It is a striking fact that, at pre-war prices, practically the whole of the pickers' houses and their furnishings at Auchterarder seems to have been secured for the sum of £8,000—approximately £1,000 per centre. The settlement there certainly represents a landmark in the evolution of housing schemes for casual labour. The system of decentralisation, whereby the

inhabitants are distributed into 8 camps, each complete, self-contained and under superintendence of a special official, marks a noteworthy advance and has gone far to solve the problem of dealing with diverse classes of seasonal workers.

Difficulty has been experienced from the beginning in obtaining a sufficient supply of suitable harvest labour. Industrial school children are extensively employed, but at present the bulk of the labour is apparently casual women workers from the towns. It will never be easy to secure adequate supplies of labour, owing to the difficulty of securing fruit-growing land near the towns and the fact that in fruit growing, as practised in Scotland, there is little diversity and hence the season is very short.

These considerations have evidently influenced the development of the housing schemes which have been outlined in this article. Scottish growers have been led to take a comprehensive view of the problem. In this respect, the co-operative character of such enterprises as Essendy has no doubt contributed largely to a satisfactory solution. It is a fair assumption, having regard to that flair for practical affairs, traditionally ascribed to Scotland, that the Scottish grower's provision for his workpeople is not philanthropy but a sound business proposition. It is recognised that suitable provision must be made if workers of decent type are to be attracted and retained, and if proper control is to be exercised while they are in residence. The erection of housing accommodation is regarded as an essential part of capital outlay. The latest Scottish camps for pickers are expressions of a wise policy, designed to secure true economy, and it is greatly to be hoped that standards in this country may approximate more and more to those attained at Auchterarder.

THE CO-OPERATIVE MARKETING OF EGGS.

MAJOR H. D. DAY,

*Chairman, Stamford and District Co-operative Egg and
Poultry Society, Ltd.*

As one of those who gave evidence before the Linlithgow Committee, the writer feels that the following account of the working and organisation of a small co-operative distributing society dealing solely with eggs may be of interest.*

* See also "A Successful Egg and Poultry Co-operative Society," this *Journal*, May, 1922, p. 171.

The standard of egg sold off the general farm is not by any means good, and this is abundantly proved by the fact that last year the Stamford Society removed 2,321 *bad eggs* from those collected. One of the principal objects of a co-operative egg-collecting society is the elimination of all eggs not up to standard from those sold as best English new laid. How this is effected by such a society when properly run is described below.

Method of Working.—The society described is the Stamford and District Co-operative Egg and Poultry Society, Ltd., and is affiliated to the Agricultural Organisation Society. Its Headquarters are a shop and premises in High Street, Stamford, and the district from which eggs are collected is roughly a radius of nine miles from this centre.

The collecting area is divided into five journeys, which are worked as follows:—Monday, 2 journeys; Tuesday, 2 journeys; Wednesday, 1 journey. All eggs are taken to the centre, where they are sorted, tested and repacked for delivery on Thursday and Friday, leaving the vans idle on Saturday for cleaning and overhaul.

The eggs collected are mainly paid for in cash by the collector who enters the transaction in a counterfoil book which both he and the member sign, thus making a receipt both ways. The original is held by the member and the carbon copy kept by the society. A few of the larger producers prefer a monthly payment, and their accounts are paid monthly by cheque on the first Friday in the month.

On arrival at the depot the eggs are unpacked, and all dirty, undersized and duck eggs are sorted out from the bulk of first-quality eggs. They are then *candled*, and all stale, cracked or otherwise imperfect eggs eliminated. As perhaps the *candling* of eggs, though one of the simplest processes in the world, is not known to all, it may be mentioned that it merely consists of holding the egg before an aperture—of about the same size as the egg—through which a bright light shines into a darkened room. The degree of transference decides the freshness of the egg, and cracks or blood spots are easily seen.

After this sorting and testing, the eggs are sold by the manager, mainly to the retail shops in Nottingham, though about 8,000 to 5,000 per week are retailed over the counter in the shop in Stamford. These sales are as far as possible arranged on the Saturday, for delivery on the Thursday and Friday following. Being thus arranged before the eggs are collected, the fixing of the price to be paid to the producer

becomes a simple matter. Delivery of the eggs is made by the same vans which do the collecting earlier in the week.

The use of motor transport has the following advantages.—

- (1) The Society's own man sees the buyer, often collects the actual cash and brings back empty cases;
- (2) It does not matter how small a consignment is left at any one shop, and many of the smaller shops pay the better price;
- (3) The manager is in close touch with customers, as he can often go over on the van with the eggs;
- (4) The careful packing required when eggs are sent by rail is avoided;
- (5) By avoiding transhipment the cases last much longer;
- (6) Motor transport is much more economical and speedy than the railway.

History.—The Society was formed in September, 1916, as the outcome of the collection of eggs for the military hospitals. It started business with the assistance of the Agricultural Organisation Society in quite a small way, collecting eggs with a pony and trap.

The first motor van was purchased in the third year and the second in the fifth year (1920), and both these are now fully employed. The following table shows the position of the Society as shown on its annual balance sheets for the seven years of its existence. The profits shown are gross :—

Year.	Capital.	Turnover.	Profit.
	£ s. d.	(approx.)	(gross.)
1916-17	132 12 6	3,750	216 17 3
1917-18	281 10 0	9,200	488 4 2
1918-19	352 12 6	12,250	285 6 8½
1919-20	382 10 0	16,500	131 12 11½
1920-21	444 10 0	16,350	42 13 11
1921-22	459 12 6	10,150	— 2 9 6½
1922-23	413 16 0	9,680	198 14 11

Unfortunately, the turnover in eggs for each year cannot be given, but for the past 3 years it has been approximately : 1,225,000 eggs in 1920-21, 1,080,000 eggs in 1921-22, and 1,257,000 in 1922-23.

This shows how the value of the egg has fallen since 1921 as, though the collections for that year were less than 1923 yet the actual value was much higher.

The position as disclosed by the balance sheet for 1922-23 is very sound, as the cash assets of the Society at the end of the financial year (6th September, 1923) were more than sufficient to cover the capital and other liabilities.

Seasonal Fluctuations.—Though the number of eggs dealt with varies greatly from month to month (the maximum for the past financial year being 43,300 eggs in the last week of March, 1923, and the minimum 8,550 eggs in the middle week of November, 1922) it is noticeable that the average value of the weekly collection only varied during the same period from a maximum of £240 in February, 1923, to £170 in July of the same year.

Eggs Collected and Prices Paid in 1922-23.

Month.	Average Weekly Collection.	Average Price per doz.	Average Value of Weekly Collection.
		s. d.	£
September, 1922	... 17,750	... 2 2	... 200
October "	... 12,750	... 2 9	... 175
November "	... 10,300	... 3 6	... 180
December "	... 15,900	... 2 8	... 215
January, 1923	... 19,750	... 2 3	... 220
February "	... 29,200	... 1 8	... 240
March "	... 33,500	... 1 3	... 210
April "	... 35,000	... 1 0	... 175
May "	... 37,300	... 1 1	... 200
June "	... 34,150	... 1 2	... 200
July "	... 27,100	... 1 3	... 170
August "	... 20,800	... 1 9	... 175
Average per week for the year	... 24,450	... 1 7½	... £197 10 0

The price given here is that actually paid to the producer, and it should be noted that this includes all eggs bought, covering all bad, cracked and small eggs. The actual price received by the society was 22.15d. per doz. and a bonus of 9d. in the pound was paid to members.

Organisation.—The staff consists of a manager, a collector and the collector's wife. The manager is controlled by a Committee of Management which meets regularly on the first Friday in each month, and two members of the Committee are detailed at such meetings to attend on the intervening Fridays to sign cheques and settle any general business the manager may bring before them.

The manager is also the secretary, and his duties mainly consist in marketing the eggs collected and keeping the books. He also works a collecting round on Monday and Tuesday. His salary is augmented by a bonus on eggs collected and a share in profits.

The collector's duty is to collect eggs on three days of the week and deliver them on other days; he also helps with testing and packing, etc., when at headquarters. His wife runs the retail shop and does the bulk of the testing. Both of them share in any bonus.

Transport.—The transport consists of two covered Ford vans (i.e., one small one and one one-ton truck). During the past year the vans have been run and kept in repair on contract by a local garage, and this has been found satisfactory. The driver being only paid for the days worked, one or two vans are used at a time as required, without the expense of keeping two permanent drivers.

Book-keeping.—The books used by this society are cash book, ledger, and two day books (one for eggs bought and one for eggs sold) and the Committee's report book. This latter is drawn up as follows and inspected weekly by the Committee:—

Particulars.	Purchases.		Particulars.	Sales.	
	Eggs.	Value.		Eggs.	Value.
		£			£
Forward from past week	87,000	620	Forward from past week	88,000	720
Bought during week ...	20,000	160	Sold during week ...	18,000	190
Expenses to date £25 per week for 5 weeks ...	—	125			
Total ...	107,000	905		106,000	910
			Stock in hand ...		800
			Written off bad to date	160	
			„ „ „ for week	40	200
Total bought—107,000			Disposed of ...	107,000	

Bank balance—£320.

Debts owing to Society—£185.

This shows the Committee exactly how things stand at the date of the meeting, and enables them to see at a glance the data required when fixing the buying price for the ensuing week.

Finance.—As regards the cost of running a society of this sort the first consideration is the capital outlay. For plant, etc., £450 should be sufficient, the principal items being two Ford vans, egg boxes (we use almost entirely second-hand colonial egg boxes, 360 size), cash register, books and office furniture. The working capital, i.e., the price of two or three weeks' collection of eggs, should be obtainable on loan.

The actual running cost of this Society last year was £1.145. with the turnover of 1,257,000 eggs. This is a cost of 2.62d. per dozen eggs for collection, testing and transport to the actual retailer. Interest on capital, depreciation and bonuses to staff cost a further 0.46d. per dozen, depreciation being high as it is necessary to write off a large amount from the cost of the vans, which were bought originally at very high prices during the War.

General.—Co-operative depots ensure the marketing of high standard British eggs, as small eggs, etc., are graded out and sold as such. Last year 2,900 odd eggs out of a total of 1,257,000 (approximately 0.02 per cent.) were graded out as bad and

destroyed. The depots save the producer all expenditure on cases, transport charges, etc., as the eggs are collected from his door, and as they are sold direct to the shops, middlemen, except the actual retailer, are cut out. They require certain geographical conditions for success. If tried in areas close to good markets, where they are in fact unnecessary, the producers can usually get a better price by taking their produce themselves to shops.

Good markets should, however, be within motor reach, as this saves much extra expense in special packing for railway transport, while the motors also collect and bring back the empty boxes, so effecting a further saving.

A certain minimum and maximum number of eggs is also essential. For a depot of the size here dealt with, a minimum of a million and a maximum of a million and a half is necessary. A smaller number would mean higher marketing charges per dozen, and a greater number a larger staff and more transport, with the same result—unless the number were very much greater, in which case a second society might possibly be the best course.

If more societies are formed near the same markets, co-ordination of marketing by them should be organised, for their mutual benefit.

* * * * *

THE STOAT.

H. MORTIMER BATTEN, F.Z.S.

NATURE works in mysterious ways with regard to the stoat. No creature can be more timid and fearful of man, yet the stoat which streaks off at one's approach, gibbering terror, is as likely as not to turn like a rattlesnake and threaten unprovoked attack. One strange fact concerning this beast, which we regard as belonging essentially to our woods and hedgerows, is its occasional partiality to suburban gardens and even town dwellings, where cats parade at night time, and where the tread of human feet and the rumble of wheels are not the least disquieting sounds by day.

A stoat has been known to take up residence in a greenhouse or potting shed or similar outbuilding, where, becoming acquainted with the sight of human beings, it soon acquired indifference towards their presence.

I have from time to time received various records of this kind, but my own experience of the wild stoat is that it will

readily forsake its chosen quarters if the presence of man becomes too frequent. This one quickly learns when attempting to photograph it.

Distribution.—It is frequently said that stoats are entirely nomadic in their habits—that except when they have young to feed they are resident nowhere. This is not always the case. Certainly stoats come and go, and the covert which is to-day free of them may a fortnight hence be over-run. In my own locality, for example, there were no stoats at all so far as one could judge last April. An epidemic of distemper had cleared them out, but it was thought by the keepers that they would reappear when the young pheasants began to run. They did not reappear, however, till the end of June, and by the beginning of August they were as plentiful as ever.

So far as one can determine a family of stoats reared, let us say, in a certain wood will continue to hunt that wood till full grown, that is, till the end of August or into September. They may be seen at the same places day after day hunting or chasing each other, but with the first autumn gales a new restlessness comes upon them, and they disappear.

This seasonal restlessness among stoats, which begins with the first fall of the leaves and lasts a fortnight or so, has often attracted notice. The madness of the March hare is proverbial, but no March hare is madder than an early autumn stoat. With the hare, however, the phrase is understandable, as March is their mating season, but with stoats the sexual instinct is more or less dormant in autumn. Yet during a windy day, when the first leaves were whirling about the hedge bottoms and the woodland corners, I have seen more stoats in a forenoon's ramble than one is likely to see during the course of any other month—crossing and re-crossing the roads more or less heedless of traffic, and bounding fearlessly about the leafy banks, where their quick movements are easily passed for a drifting leaf.

At first glance this characteristic would seem to indicate migratory instincts, which would appear to have some bearing on the distribution of the species. It has already been said that the young haunt their home quarters till wild weather begins, when, in view of the lean months ahead, the instinct comes to them to find other quarters. So the first storm winds bring about an immense shuffling and re-sorting among the beasts which, all summer, have come little before our notice, owing to the sheltered and shut-in lives they have led. Some

of the families, to be sure, remain united into the winter, and family may join family till a pack is formed, but normally the families break up in early autumn.

But what about the new stock of stoats which turned up in my own locality during the month of July? To advance a theory would perhaps be rash, but I examined seven of these new-comers, everyone of which was an old dog—from which significant fact one is at liberty to draw one's own conclusions.

Summing up, then, I concluded that the mother and young haunt the vicinity of the nest till September or October. The male may or may not remain with his mate. In the majority of cases he does not, but lives a nomadic life the year round, and he is one of a great army of old males who, having been unable to hold their own against their own sex (or the opposite) have no family ties at all. The young begin to wander in autumn. Some of them become anchored by exceptionally good hunting, but the majority remain nomadic till they in turn have family ties. So we have at all seasons an immense number of nomadic stoats, in addition to those which, during spring and summer, escape notice by the retired lives they lead.

A Stoat's Larder.—At one time I had under close observation one of the many abandoned lead mines in the West Riding of Yorkshire, which were shut down thirty years or so ago. This particular mine is situated in the wild stretch of moorland country between Grassington and the valley of the Nidd, and wild life of all kinds finds sanctuary in the underground culverts and the immense masses of crumbling masonry.

One evening I saw a stoat run out of the furnace house with a frog in its mouth, and in the centre of the heavily paved washing floor it sat bolt upright, cutting a grotesque little figure as its elongated shadow fell across the flags. For fully a minute it sat without twitching a muscle, then with that spontaneous action peculiar to the weasel family, it dived through a chink in the flag on which it had sat. After a minute or so it reappeared from the same chink but without the frog, and having surveyed the landscape it darted off into the gathering gloom.

Thinking that the animal had its family under the flag, I went to some pains in rooting it up, and though there were no young stoats, my efforts were rewarded by the discovery of a genuine example of a stoat's larder. The frog most recently deposited was there alive, though it appeared to be paralysed by the scarcely discernible bite at the back of the head. There

was half a grouse egg which had lain exposed to more than one hill storm, since the colour was washed from its surface; a great deal of sheep's wool—probably bedding—a kippered worm, which must have been a veritable boa-constrictor in its best days, and a good deal of rabbit and mouse remains. There may have been other oddments, but I have forgotten. Evidently the larder was used as a dining-room and occasionally as a bed-chamber, for there was no real stock of food.

I believe that every stoat which has an established hunting range has several such caches, to which it drags food when in the mood; but a nomadic stoat eats where it kills and sleeps when fed. Thus this animal has been found asleep in the nesting-box of the hen-house he had recently invaded, surrounded on every side by the evidence of his crime.

Voice.—Probably very few observers have heard the “bark” of a stoat, but it is a sound which, once heard, is not forgotten. One night I took one of these animals in a box-trap set in the garden at no great distance from my bedroom window, and during the night the stoat, while attempting to escape from the wire portion of the trap, was struck at by an owl. Thus I was wakened by a veritable pandemonium. Inside the trap, the stoat was barking repeatedly, while on a post near by the owl hooted and screeched. Clearly deadly foes had met, and each was much enraged.

The bark is almost identical to the sound caused by beating two flints together, and it is sufficiently powerful to carry two or three hundred yards. In this case the stoat kept it up for thirty minutes or more after the owl had left, and so haunting and malicious was the sound that it rang in my ears for some time.

Ferocity.—Stoats will attack practically anything they can catch and hold, and within my experience a pack of them attacked a lesser black-backed gull, which is certainly a formidable bird. The gull was roosting on a mound in the centre of a peat hag, and many other gulls occupied the swamp. The big gull was seen to rise, struggling desperately to obtain command of the air. Flapping and screaming it made its way across the swamp, where it fell into the rushes, and when the observer got to the place he found the bird almost dead, and saw several stoats run off through the rushes. This occurred in the West Riding.

Other cases are on record of stoats having been attacked by hawks, resulting in the death of both of them, or at any rate of the hawk.

Musk Glands.—In all the weasels, excepting the marten, the musk glands are highly developed. In the case of the badger, the secretion is not so nauseous as in the other weasels, nor is it used for the same purposes. It has, indeed, been said that the glands are provided in the case of the badger as a subsidiary means of tiding over the foodless months, but if this be so, their use is unique.

The value of musk glands, it is generally admitted, is to afford a means of bringing the sexes together, and doubtless they are there for this purpose in the case of the weasels. So highly developed are they in certain instances, however, that Nature seems to have run riot with her original scheme. Thus the skunk possesses the power of ejecting the musk in a fine choking spray which no beast will face, and there can be little doubt that stoats, weasels and polecats also possess this power to a much less degree. With them it merely amounts to being able to control the amount of scent they give.

Do stoats and weasels use their musk scent in their hunting?

The available evidence would seem to prove that they do. It is known that a hare will run for miles from a marten, which is a practically scentless member of the weasel family, but how far will a hare or a rabbit run from a stoat? Not more than a mile or so at the most, for once that deadly taint reaches him he becomes paralysed with terror.

One day when motoring from Peebles to Edinburgh and when near to Leadburn I saw a rabbit cross the road and take shelter in some whins, while its manner of progress clearly indicated that it was being run by a weasel. I stopped the car to watch proceedings, and five minutes later a stoat appeared, running the trail of the rabbit. He saw the car and its occupants, and hesitated in crossing the road. With characteristic curiosity he came up towards us to investigate, and on his reaching a certain point the wind bore in a direct line from him to the rabbit, and at that precise moment a pitiful squealing was heard from the whins. This seemed to excite the stoat, and returning to his original line he crossed the road and went straight over to the gorse bush, whereupon the squealing ceased. Going up, I found the dead rabbit. In this case, as in others which could be recorded, the quarry gave up immediately it obtained the deadly musk scent of its pursuer.

For all their extraordinary abilities, stoats, like most beasts which are short in the leg and whose horizon, therefore, is limited, are possessed of very poor eyesight. They fear the



FIG. 1.—Stoat taking up a Bait.

scent of man greatly, but if they cannot scent him and can merely see him, they will watch curiously till within a few feet. This is a point to bear in mind when the stoat is seen at a distance, for by making use of the wind one can generally approach sufficiently closely for shot and powder to be effective.

Hunting in Trees.—Stoats are first-rate climbers, and where there are plenty of small birds and wood pigeons they habitually hunt ivy-covered trees. In Northamptonshire a partially devoured wood pigeon was found in an ivy tree, and a trap was set alongside it to discover the culprit. Next morning the trap was on the ground with a stoat fast in it.

Natural Enemies.—The stoat has no particular animal foes. Very few dogs, even, unless hardened hunters, will face this nausous little musk bearer. More stoats are killed by stoats than by all the keeper's devices, and were this not so, game preservation would become difficult in many localities.

When stoat meets stoat it is either as mate or as deadly foe. In nine cases out of ten it is the latter. One turns and flees, and unless he or she makes good its escape, a fight to a finish is certain. They are the most deadly cannibals I know, and no bait is so irresistible to a stoat or a weasel as a member of its own race. Time and again I have known such a bait to produce results when all else had failed.

Trapping.—This brings us to the subject of trapping these bloodthirsty little beasts. In using steel traps a bait is not generally employed, as it attracts other creatures which will spring the trap and consume the bait.

Every keeper should have by him one or two good box-traps, and the accompanying sketches show the devices which the writer has found most convenient and effective. While at it, a thoroughly good article should be made, as shoddy workmanship only leads to unreliability, whereas a well-made box-trap will last a lifetime.

Fig. 2 is a double-ended trap, and is useful during the running season, as when one stoat is caught a second is almost sure to go to it and will thus be found in the adjoining compartment. Fig. 3 shows the best all-round trap for general use. As will be seen it consists of a tunnel, having a trap door at either end. On the spring plate being depressed, the doors close simultaneously, for it will be seen that any pressure applied to the spring-plate tends to move the crank controlling the doors over the dead centre position, in which it is poised when the trap is set. The bait is suspended from the lid of the

trap directly above the spring-plate, and the stoat, endeavouring to tear it down, is bound to spring the device. One of these

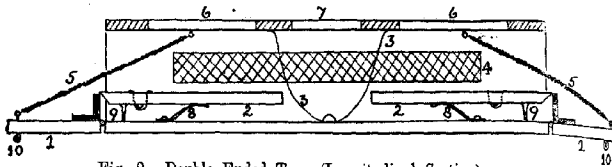
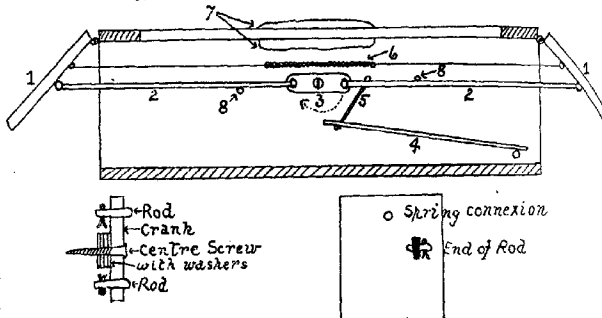


Fig. 2.—Double Ended Trap (Longitudinal Section).

1. Trap Doors.
2. Spring Plates.
3. Wire Netting Tray in which Bait rests.
4. Wire Netting Windows (both sides).
5. Door Springs.
6. Lids to separate ends.
7. Lid for renewing Bait without disturbing trap.
8. Light Clock Springs to return Spring Plates.
9. Screws fixed in floor to serve as stops for Spring Plates.
10. Leather Tags for opening doors. To set Trap the doors are simply opened, whereupon the spring plates automatically engage with the triggers.



Inside view of Door

Fig. 3.—“Straight through” Box Trap (Longitudinal Section).

1. Trap Doors.
2. Thick Wire Rods which actuate doors.
3. Crank, free to rotate on its centre screw. As shown it is at dead centre, and both doors are propped open. As the crank turns in direction of arrow both doors close.
4. Spring Plate.
5. Cord connection between spring plate and crank.
6. Door Spring.
7. Strong Spring in lid for bait and handle.
8. Stops.

should be set along a wall bottom with iron traps on either side of it.

Mating.—Running begins in February, and the young, five or six in number, are born for the most part early in April. By the middle of that month the keeper should keep a close lookout for them, as even before their eyes are open the mother will often bring them out to bask in the sun. A little later they play about the den mouth, quite fearless of man, but if

disturbed the dam will remove her litter quickly as a vixen, and they are then lost for all time. Thus, when following the dykes or woodland banks at this season, the keeper, or whoever it be, needs to keep very keenly alive, and to move as quietly as possible.

Stoats will breed anywhere that adequate shelter exists. I have known them to breed in stone walls, in ruined buildings, in upturned tree roots, and in rat burrows about the hedge bottoms. Generally the nest is built of leaves, and sometimes of grass. When running, stoats follow stone walls for preference, showing a special partiality to certain walls which become known to the keeper as time passes. The animals are still comparatively rare in my own locality, but there is one ancient wall which runs for miles across country where they can be trapped with some regularity.

Colour Change and Value of Tail.—The *sine quâ non* of the stoat is, of course, his black tipped tail, which follows him everywhere like an angry hornet. Almost as often as not the black tip is what catches the eye.

The tail of the stoat bears evidence to an ancestry more arboreal in habits than were the ancestors of the weasel and the otter. Evidently this animal springs from the same line as the martens, and its comparatively bushy tail has its distinct uses. The tail of the squirrel is his rudder, his parachute. It assists his leap, it breaks his fall, it enables him to land head upwards on the vertical trunk. So anyone who has seen stoats hunting each other will have observed the important part the tail plays. Bushed out like a bottle brush, it is whirled this way and that with every lightning double and twist, and it is suggested that a wild stoat deprived of its tail would not long be able to exist. It would disappear, just as certainly as does the squirrel on which such a mishap falls.

Stoats begin to assume their winter coat in November, and the change back occurs during February and March. A great deal depends upon the altitude and the climate of the range they haunt. Those which inhabit high country are usually quite white by December, and may remain so till the middle of March, whereas a stoat living in the low country may merely become camouflaged with white, as though with pardonable uncertainty as to what the weather gods will send.

Indeed the colour change of the stoat presents one of the curiosities of nature, and at the time of writing zoologists are at work in the hope of throwing new light on the subject.

THE IMPORTANCE AND VALUE OF POULTRY FEATHERS.

Communicated by the Rural Industries Intelligence Bureau.

POULTRY keeping, at one time little more than a sideline of merely secondary importance to the majority of those undertaking it, has of late years developed into a highly organised and scientifically conducted rural industry, on which an increasing number of people tend to rely for a partial, indeed, in many cases, for a principal means of support. A particular feature since the War has been the large number of ex-Service men who have taken it up for a living, in most cases on a small scale.

There is no intention in these brief notes of dealing in any way with the technicalities of poultry husbandry. This subject is outside the scope of the Bureau's activities, and is amply catered for by many competent and valuable organisations, periodicals and text books. Nevertheless, poultry keeping is not so remunerative that those engaged in it can afford to neglect possibilities, however small, of adding to its earning capacity, and this is especially true when the occupation is carried on in a comparatively small way.

Various indications suggest that quite a considerable proportion of poultry keepers overlook the fact that the feathers of their birds are a marketable commodity, and though business practice may often entail sending away living or unplucked birds, feathers which might be collected and disposed of are, in a very large number of cases, treated as valueless rubbish.

Imports.—The following figures will give some idea of the quantities of feathers that are annually imported into the United Kingdom from abroad:—

	1913.		1920.		1922.	
	Cwt.	Value	Cwt.	Value.	Cwt.	Value.
		£		£		£
France ...	3,778	11,108	2,239	21,100	3,260	12,250
Germany ...	3,553	35,715	507	14,975	435	1,577
Netherlands ...	45	297	4,989	28,308	86	586
Denmark ...	—	—	—	—	4,491	34,179
China ...	9,989	33,923	27,867	223,692	18,292	79,876
Hongkong ...	18,616	55,669	36,551	245,309	21,467	87,841
Japan ...	3,330	3,867	37	329	636	1,319
U.S.A. ...	3,329	6,515	5,311	22,077	12,827	21,294
Other countries	2,376	12,272	2,114	31,726	4,612	29,543
TOTALS ...	45,016	£159,366	79, 15	£587,516	68,104	£268,765

For purposes of comparison the following totals for intermediate years are added :—

1919—52,468 cwt. valued at £284,791.

1921—27,894 cwt. „ „ £146,644.

It will be evident that after a heavy drop in 1921 from the high figures and prices of 1920 the demand for this commodity is again very decidedly on the increase.

Besides imports from foreign countries into Great Britain, considerable supplies come from Ireland to Great Britain, as the following figures will show :—

1913—20,824 cwt. valued at £42,680.

1920—15,557 cwt. „ „ £72,599.

All the above figures relate to imports of the cheaper sorts of feathers (described as “ in or for beds ”), i.e., poultry and the like, and do not include the rarer and more valuable kinds such as are used for expensive millinery and other ornamental purposes.

It is hoped by these extracts from official sources to bring prominently to the notice of those interested in poultry keeping in this country, the fact that poultry feathers are the raw material of quite a considerable industry, for which by far the greater proportion of the present supplies is now obtained abroad. There can be no doubt therefore that the collection of these feathers is well worth the attention of the poultry keeper at home.

Grading.—Poultry feathers should be graded as follows :—
1. Down feathers; 2. Soft feathers; and 3. Stiff wing and tail feathers, usually referred to generally as quill feathers. In addition, white feathers, which are more valuable, should be kept separate from coloured ones.

Uses.—Down feathers are used chiefly for stuffing mattresses, pillows, cushions, etc. Soft feathers are also in many cases used for similar purposes, but they have a further use in the millinery trade, and by no means only for the least expensive class of goods. White feathers command the highest price for these purposes. It is generally considered that imported feathers are better than English ones, and they have in the past realised better prices, but the main reason for this preference appears to be that they are more carefully graded and prepared to suit the feather merchant's requirements.

Quill feathers are of less value and use now-a-days than either of the other kinds. Not all dealers will accept them, but they are nevertheless used for a number of purposes, amongst which may be mentioned the manufacture of feather dusters and certain other articles in the fancy goods and artificial flower trades.

whilst the smaller sizes are also sold in small bundles as pipe cleaners. One or two merchants exist as dealers in quill feathers exclusively.

Preparation of Feathers for Disposal.—The price to be obtained will greatly depend on the care taken of the feathers by the collector. If possible, the feathers should be graded when plucked, both as regards colour and quality. Quills should always be kept separate and fowl feathers should be kept separate from those of ducks or geese, as these are of much greater value. It is important that all feathers to be sold should be as clean as possible and quite dry. As previously mentioned an important reason for the buyer's preference for foreign feathers is that these particulars are more carefully attended to.

In the case of feathers which it is intended to dispose of to feather merchants it is not necessary to take any steps to "cure" them, in fact merchants as a rule prefer that the feathers should not be previously treated, as they have special machinery for this purpose. Should it be desired, however, to use the feathers at home for making cushions, etc., the following process is sometimes used :—

To clean the feathers from their animal oil they should be steeped in lime water made in the proportion of one lb. of lime to each gallon of water. The lime residue should be removed from the lime water before steeping the feathers. The feathers should be well stirred into the lime water and then allowed to remain in it for some hours, after which the lime water should be poured off and the feathers thoroughly rinsed in cold running water.

To clean the feathers from dirt only, wash them with soap in hot water and rinse with warm water afterwards. After rinsing they should be well drained either in a sieve or on a wire frame, and well shaken about while still warm, after which a moderate amount of further artificial warming will dry them completely. They should be kept loosely packed in muslin bags, hung up in a dry loft, so that air can circulate round and keep them as far as possible from any chance of getting damp, until sufficient have been collected. If they have to be retained thus for any length of time, they should be examined now and then to see that they are free from moth.

The methods outlined above are to be regarded more as preservative than as adequate purification, and feathers so treated would still have to go through a more thorough and scientific process in the factory before being fit for industrial purposes.

Prices.—Prices depend very much upon quality and condition, and also to some extent upon the quantities offered. Better prices will be obtained by dealing direct with firms of feather purifiers than by selling them to travelling collectors or middlemen.

While most of these firms do not care to take small lots, and stipulate for quantities of not less than one or two hundredweight at a time, there are some who will buy small parcels, provided the contents are sorted, graded, clean and dry. Carriage, however, may generally have to be paid by the sender on lots under 2 cwt. or so. It is understood that the prices at present obtainable are approximately as follows:—

Fowl feathers, picked clear of wing and tail quills—

Coloured—3½d. to 5½d. per lb.

White—5½d. to 6½d. per lb.

English Duck feathers, picked clear of wing and tail quills—

Grey—1s. 2d. to 1s. 8d. per lb.

White—1s. 8d. to 2s. 3d. per lb.

English Goose feathers, picked clear of wing and tail quills—

Grey—1s. 6d. to 1s. 9d. per lb.

White—1s. 10d. to 2s. 6d. per lb.

Duck and Goose quills—3d. to 3½d. per lb.

For fowl quills there is only a limited market at 1½d. to 2d. per lb.

Turkey body feathers vary considerably, both as regards demand and price, the latter at present being between 4d. and 7d. per lb.

Turkey quills 2½d. to 8d. per lb.

Methods of Disposal.—The Ministry of Agriculture will, on request, send to any poultry keeper having feathers to dispose of a list of dealers in feathers. Applications should be addressed to The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1. The Bureau is also prepared to assist applicants as far as possible in a similar way.

Copies of this article, in the form of a leaflet, and additional information on matters arising out of it, can be obtained on application to The Secretary, Rural Industries Intelligence Bureau, 258/262, Westminster Bridge Road, London, S.E.1.

HORTICULTURE IN THE ISLES OF SCILLY.

B. L. WOLF and A. D. R. WALBANK.

Ministry of Agriculture and Fisheries.

FIFTY years ago commercial flower growing was unknown in the Isles of Scilly. Farming and fishing were the normal occupations of the islanders. With regard to the former, the stock consisted of milch cows, sheep and pigs, with the minimum complement of horses needed for the somewhat restricted farming operations carried out. The soil was too light for wheat,

a certain amount of oats was grown, but the main crop relied upon was barley, utilised for bread-making for home consumption. Late potatoes were produced and those surplus to domestic requirements were exported to France and Portugal. Early sorts were not cultivated in those lean farming days when the inhabitants of the islands lived a hand-to-mouth existence and the potentialities of the soil and climatic conditions had not been discovered. It is probable that fishing was more extensively engaged in then than at the present time. The bulk of the fish was marketed in Brest.

The Birth of the Flower Industry.—Forty-three years have elapsed since the first steps were taken towards the establishment of the flower industry, and it is highly improbable that its pioneers foresaw that it would reach its present dimensions. A few Soliel d'or, Scilly White, and possibly some Double White Narcissi, growing in the islands, and till then practically ignored, were planted out and cultivated for the production of blooms for market. It is believed that these were disposed of in Penzance, and good prices were realised for the magnificent flowers produced. This humble beginning in the cultivation of a few narcissi opened up the prospect of a way out of the poverty which the islanders had for so long endured. The next step seems to have been the introduction of *Ornatus* from the districts around Paris. Then came *Princeps*, *Obvallaris*, *Henry Irving*, and, in due course, other varieties which are still known and welcomed in the English markets. Little by little the advantages of the equable climate and warm soils were disclosed, until to-day flower growing is the staple industry—in fact, it would appear, that upon the continued success of this industry depends the future prosperity of the Scillies. Doubtless there are side-lines which may come in very usefully, such as early potatoes, which have been profitably exploited, asparagus and other items yet to be determined, but it is difficult to predict any crop that will displace the cultivation of flowers as the main source of revenue. Assuredly, plants other than bulbs will play their part in a well conceived rotation, but always as a preparatory crop for the betterment of the soil conditions in view of the production of flowers for the early markets.

The Present Difficulties of the Flower Industry.—During the past few years increasing difficulty has been experienced in procuring good crops of flowers. Recent investigations made in the islands point to the probability of a number of factors contributing to the conditions responsible for the declining yield. Some of the soil is undoubtedly sour and unbalanced, owing to

the indiscriminate use of artificial fertilisers, the inadequate use of lime, and constant cropping with narcissi. Eelworms have been found to attack bulbs; bacteria and fungi are also present. It is not to be inferred that the islands are full of disease and that the flower industry is on the verge of disaster. Far from it! But the state of the soil and the introduction of the pathogenic organisms referred to above are sufficient to arouse apprehension as to the future. The inhabitants of the Scillies have initiated and built up an industry, and the same persistency and determination to succeed that have characterised them in their years of effort, are evidencing themselves now in order that the hard-won position may be consolidated and maintained. The combination of circumstances that has arisen to hinder them in their march to prosperity has no doubt influenced them in their decision to avail themselves of the opportunity of setting up a system of Horticultural Education which has presented itself through the action of the Duchy of Cornwall and the Ministry of Agriculture.

System of Horticultural Education.—The Council of the Isles of Scilly is responsible for education in the islands. There are five schools, one on each of the inhabited isles. The schools are maintained out of local rates, a grant in aid of approved expenditure being paid by the Board of Education as in the case of such expenditure incurred by Local Authorities on the mainland. The Council has now transferred its powers with regard to agricultural education to the Agricultural Committee, and a grant in aid of approved expenditure under this head will be paid by the Ministry. The Duchy of Cornwall is making a special contribution to the rates for the purpose of the scheme.

The Agricultural Committee has appointed an advisory research worker, who will reside on the Island of St. Mary's, and act as technical adviser to the Committee. He will also give lectures and pay advisory visits to growers on each of the islands.

Proposed Experimental Station.—Some ten acres of land have been put at the disposal of the Committee, by the Duchy of Cornwall, for the purpose of establishing an experimental station. All problems relating to bulbs will be dealt with here. Manurial and variety trials for bulbs and early potatoes will be undertaken, and new sorts tested. Other crops likely to prove useful in balancing the rotation and for early market work will be grown. This new departure will be watched with interest. It is the only experimental station specially interested in bulbs in Great Britain, and possibly in the world.

The Control of Plant Diseases.—Another innovation in the islands is the erection of a bulb sterilising plant. The Duchy of Cornwall has had this plant installed for the use of growers and it will be run, as far as possible, on a self-supporting basis. Those wishing to have their bulbs sterilised will be able to do so upon payment of a small fee, thus relieving them of the necessity of making a capital outlay for the purchase of their own sterilising plant. The proposal is to have an experienced man in charge of the plant, who will also be attached to the experimental station and be able to fill in his spare time at the farm.

By request of the growers, the Ministry has issued an Order, entitled "Bulb Diseases (Isles of Scilly) Order, 1923," which came into operation on 1st January, 1924. The provisions of the Order are designed, *inter alia* (a) to impose restrictions on the importation into the islands of daffodil and narcissus bulbs; (b) to procure the destruction or treatment of diseased bulbs which may be present within the islands.

The Future of the Flower Industry.—The islanders are to be congratulated on the enterprising methods which they are entertaining for the preservation and development of their industry. They are gradually adopting more modern ways of packing and marketing their produce.

They have two Growers' Associations, one on St. Mary's and one on Tresco, which witness to their belief in co-operation. It is to be hoped that co-operative methods will be developed and the logical conclusion reached in the amalgamation of the associations now in being. In the recognition of such potent factors as co-operation and education in the development of an industry, their business acumen is disclosed. When the application of the results of scientific research displaces where necessary old practices based upon past precepts, there should be no misgivings regarding the prosperity of the flower industry of the Isles of Scilly.

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WOODLICE IN GLASSHOUSES.

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THE woodlice inhabiting glasshouses are limited to a few species, some of which, however, occur in enormous numbers.

As one would expect, some are found commonly in the neighbourhood of glasshouses, and enter during the winter months

to obtain shelter. Others seem especially adapted to life at high temperatures such as obtain in cucumber houses during the summer, and seldom, if ever, occur far from the houses, though they are capable of withstanding severe frosts outside, provided that they can bury themselves to some depth in heaps of soil. The general food of woodlice consists of decaying or fermenting cellulose, but they will, under certain circumstances, gnaw the stems and roots of healthy plants, and some even climb to eat pear-shaped holes in the leaves.

Certain species of the genus *Armadillidium* cause very serious damage to growing plants. *Armadillidium speyeri*, Jackson, and *A. pictum*, Br., are practically confined to cucumber houses, the former being exceptionally abundant and voracious. *A. vulgare*, Latr., the common pill woodlouse, is found more often in the cooler tomato houses, is very numerous in peach houses, and is also found in the nests of ants. All these roll up into a ball when disturbed, a complete sphere being formed by the broad and bulky *A. vulgare*, while in the other two more slender and active species the tail appendages overlap the head. Two other species are common in tomato houses, namely, *Porcellio laevis*, Latr. and *Haplophthalmus danicus*, B. Lund, but they do little damage to the plants.

The breeding season for these woodlice occurs from early spring to August. The young escape from a specially developed pouch on the underside of the thorax in which the eggs develop.

Winter Habits.—On the approach of winter, *A. vulgare* buries itself to a great depth in the ground and there remains inactive. The species found in cucumber houses, however, remain more or less active, unless they are taken outside when the borders are cleared from the houses. In the latter event they will remain buried until spring, when they become active and readily regain access to the houses.

Damage to Plants.—The species of *Armadillidium* are brought into propagating houses in great numbers from heaps of soil which have been stacked outside during the winter. When the seedlings appear in the boxes, the hungry woodlice at once find a suitable supply of food. *A. speyeri* causes most loss by biting through the stems of tomato seedlings near the soil level, and *A. vulgare* is also responsible for similar damage, though to a less extent. At this time, the cucumber seedling is not so liable to attack. When the plants are potted out *A. vulgare* ceases its activities, but *A. speyeri* turns its attention to them.

Pear-shaped holes are eaten in the lower leaves, the cotyledons often being entirely destroyed, and in severe cases a considerable portion of the leaf-surface is removed. Such damage is continued throughout the growing season upon plants in the border unless control measures are employed.

Late in the season, *A. speyeri* has been observed to do considerable damage by eating the petals of carnation flowers. *A. vulgare*, on the other hand, is much less harmful and usually leaves tomato houses in May or June. As the cucumber borders are top dressed throughout the growing season from heaps of soil and manure outside, the number of woodlice increases to an enormous extent as the season advances. *A. vulgare* is particularly addicted to removing the bark from branches of peach-trees. Both species feed mostly at night.

Control Measures.—In glasshouses, control measures may be divided into two categories:—(1) Destruction of woodlice in the winter; (2) Trapping in summer.

(1) **Destruction of Woodlice in the Winter.**—At the end of the season when the border soil is removed from the cucumber houses, great numbers of woodlice are taken away at the same time. Those that remain may be destroyed by hot water or cresylic acid.

(a) *Hot Water Treatment.*—Where apparatus is available for the distribution of water at a high temperature in glasshouses, the treatment is undoubtedly the most radical in the control of woodlice. To determine the effect of temperature on these woodlice, a thermostatic bath was employed. In this was placed a vessel containing soil into which the woodlice could be introduced. With the water in the thermostat at 147° F., the soil at an internal temperature of 146° F., and with a surface temperature of 124° F., all woodlice introduced on the soil surface were killed in 30 seconds.

With the thermostat temperature at 140° F., the soil internally at 136° F., and the soil surface at 108° F., woodlice similarly introduced were killed within two minutes. Woodlice dipped for half a second in water at 149° F., died within a few minutes after immersion. These experiments show that the *Armadillidium* is easily killed by water at comparatively low temperatures and accounts for the efficiency of the hot-water treatment.

(b) *Cresylic Acid Treatment.*—If the necessary apparatus for hot-water treatment is not available, the woodlice may be

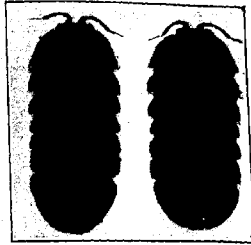


FIG. 1.—The Pill Woodlouse (*Armadillidium vulgare*, Latreille) enlarged: (left) male: (right) female. Note the absence of the rostrum on the head, and the thick rounded appearance of the animal.

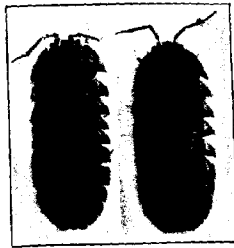


FIG. 2. - The Cucumber-house Woodlouse (*A. s. eyeri*, Jackson) enlarged: (left) male: (right) female. Note the shape of the tail appendages and the very prominent rostrum on the head.

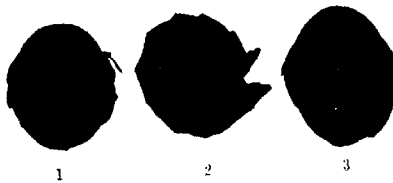


FIG. 3.—(1) *A. speyeri*, Jackson. Anterior view of animal rolled up.
(2) *A. speyeri*, Jackson. Side view.
(3) *A. vulgare*, Latreille. Anterior view of the animal almost rolled up.

Note the straight line formed by the edge of the posterior segments in No. 3, and the projection of the abdomen beyond the head in No. 2.

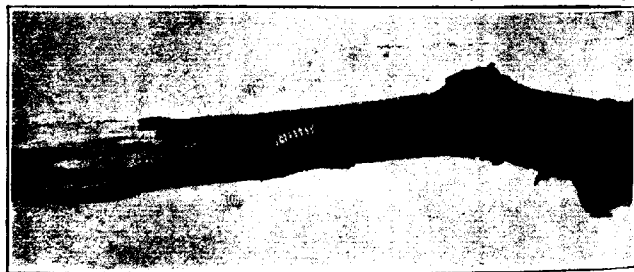


FIG. 4. *Acetabularia spirogyra* (L.) Kuhn.
A young specimen, showing the young.

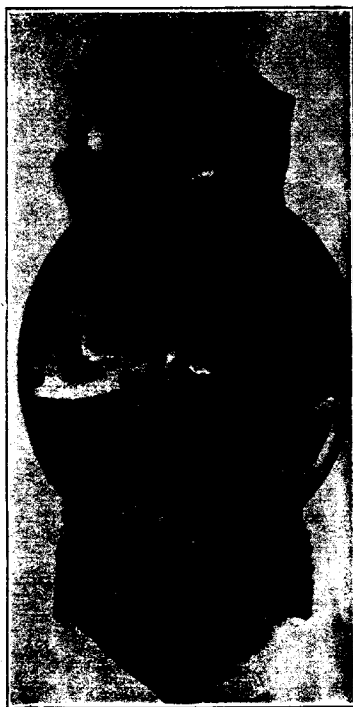


FIG. 5. Showing changes in *Acetabularia* (L.) Kuhn.
A young specimen, showing the young.

destroyed by spraying thoroughly the soil, walls, and woodwork with the following mixture :—

Cresylic acid (pale straw 97-99 per cent.)	...	1 gallon.
Potash soft soap (household)	...	8 lb.
Pure naphthalene	...	$\frac{1}{2}$ lb.

These are heated together in a bucket till the soap is melted and the naphthalene dissolved. For spraying, 2 pints of the mixture are used to every 12 gallons of water.

The following experiment serves to illustrate the effectiveness of this treatment. A cucumber house 15 ft. \times 12 $\frac{1}{2}$ ft. (1,000 cubic feet space) was treated exactly as described above in November, 1922. Two days after spraying a collection was made from one side of the house only, and the following figures show the relative proportions of living and dead woodlice :—

	Dead.	Living.
<i>Armadillidium speyeri</i> ...	481	5
<i>Armadillidium vulgare</i> ...	98	1
<i>Metapornothus pruinosus</i> ...	1	6
Total ...	580	12

This represents a mortality of just under 99 per cent.; the efficiency of the mixture is due in part to the cresylic acid and in part to the naphthalene.

2. Trapping in Summer.—It has been remarked that these woodlice feed for the most part upon decaying cellulose, and that they obtain an ideal supply of food in the cucumber borders. This makes it a matter of great difficulty to attract them with any substance used commonly in baits. As an attracting basis coarsely ground oatmeal has been found more useful than bran, flour, or starch; it becomes specially attractive to the woodlice when mixed with glucose or treacle. Laevulose, saccharose, mannite and glucose were tested; the last appeared to be most attractive. In our experiments, which were carried out with several arsenical compounds, we have stained the poisoned oatmeal with cochineal, and after several days have dissected the woodlice to make sure that they have eaten the bait, the red cochineal being readily detected in the stomach of the woodlouse. In not a single case has a woodlouse died from eating these poisons, although in all cases the bait has been found in the intestines of the animal when dissected.

After a number of unsuccessful trials with compounds containing copper, it was found that substances containing chromium had the desired effect, the soluble bichromates being the most

satisfactory. Of the latter, potassium bichromate when used in a solution above $2\frac{1}{2}$ per cent. strength caused death in every case. Solutions containing but a trace of potassium bichromate when injected into the bodies of woodlice have produced almost instant death.

A bait consisting of oatmeal 10 parts, glucose 2 parts, potassium bichromate 1 part, and water 10 parts, costing about 3d. per lb., which acted consistently on woodlice kept in jars and dishes, was only successful to a slight degree when used on cucumber borders, owing to the difficulty of attracting the animals from their natural food. It still remains, however, to give this bait a trial in the propagating houses, where it will be more useful, being distributed at times when the woodlice are short of food.

Pot-trapping.—The use of inverted flower-pots filled with straw has long been in vogue for catching woodlice. The following tables show the numbers caught with various materials in the pots :—

November, 1921. Average number caught in one pot per night on cucumber house subsoil.

<i>Substance.</i>	<i>Average number caught in one pot over four days.</i>
Common straw treated with boiling water	43
Border straw + dung, untreated	74
Ditto, treated with boiling water	104
Fermented straw	154
Common straw treated with boiling water + molasses	272

August, 1922. Actual numbers caught in one pot per night on cucumber border with growing plants.

<i>Substance.</i>	<i>Numbers caught in one pot.</i>				<i>Total.</i>
	<i>1st day.</i>	<i>2nd day.</i>	<i>3rd day.</i>	<i>7th day.</i>	
Common straw, untreated	2	2	0	3	7
Common straw, untreated + 5 per cent. glucose	5	7	2	8	22
Fermented straw ...	3	15	30	43	91
Fermented straw + boiling water	0	4	0	0	4
<i>On another border:</i>					
Fermented straw ...	200	170	122	50	545
Fermented straw + 5 per cent. pot. bichromate ...	38	100	14	8	160
Fermented straw + 10 per cent. pot. bichromate ...	0	2	0	0	2
Fermented straw + 10 per cent. calcium bichromate	2	0	0	5	7
Common straw, untreated	530	32	0	14	576
Common straw + 10 per cent. glucose	2,500	200	12	0	2,712

These figures show that fermented straw is more attractive than unfermented, and that the addition of glucose to common straw increases its attractive qualities; that addition of potassium or calcium bichromate makes the straw distasteful; and that the attractive ingredients in fermented straw are soluble in water and can be extracted.

Further, it is seen that in a given area the number of woodlice decreases with consistent pot-trapping. Any method of this kind is, however, laborious on a large scale, and is only successful over limited areas.

Vegetable Baits.—By far the best control, both in cucumber and tomato houses, is attained by the use of red beets or mangolds. These are cut in halves and placed face downwards on the soil, one half to every four plants. The woodlice collect in large numbers on the vegetables, and are shaken every morning into a pail of hot water. All the woodlice cannot be destroyed by this method, but they are kept from feeding on the plants. Red beets are preferable to mangolds as they decay less rapidly, the former lasting from six weeks to two months.

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DESTRUCTION OF WIREWORMS.

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THE following figures are the result of a study of the numbers of wireworms in arable land made during the years 1914 to 1922 inclusive. Most of the figures refer to land ploughed up from pasture, and show the gradual reduction under cultivation of the huge numbers in the original pasture. No special treatment was given in any of the fields and no insecticidal dressing was added.

The method adopted in obtaining the figures was to dig out portions of soil in different parts of the various fields, carefully crumble and sift the samples, and count the wireworms in them. The size of the test samples of soil was at first one foot cube, but later blocks 9 in. square on the surface and 1 ft. in depth were used.

The number of test samples in a field varied from five to twelve, and in subsequent counts on the same field the same number of samples was taken. The average number of wire-

worms found in the samples from a field was then multiplied to obtain an estimate of the number per acre.

Permanent Grass Fields.—Samples were taken from eight pastures, varying in size from $9\frac{1}{2}$ to 14 acres and in soil from light loam to heavy loam. The estimated number of wireworms per acre in the different fields was found to vary from 108,000 to 900,000, the average being 805,000. In four arable fields which had been over five years under cultivation the number varied from 44,000 per acre to 95,000 per acre, the average being 81,000.

It will be seen that the wireworms were approximately four times as numerous in the grass land as in the arable land. In general they were more abundant in the lighter soils.

Depth Distribution and Local Movement of Wireworms in the Soil.—Although no attempt was made to count the numbers at different depths the following observations were made. On grass land the wireworms were near the surface, the great bulk being in the mat of roots in the top inch of soil. Relatively few were below 3 in. and they were rarely found lower than 6 in.

There was no evidence of a downward movement during cold weather. The observations were made during the worst months of the year, and several times counts were made immediately after very severe frosts. On one occasion during 18 degrees (F.) of frost lumps were chopped out of the surface. The wireworms were embedded tightly in the frozen mass and were alive and unaffected after the subsequent thaw.

On arable land the wireworms appeared to avoid the dry loose surface and were found to be most numerous at 3 or 4 in. depth: they were frequently about 6 in. deep but very rarely below 9 in.

The crop grown on a field, however, exerts a considerable influence on their local movements. With cereals and "seeds" they remain fairly evenly distributed, but with more widely drilled crops they collect in quantity along the rows and are often closely massed together. White turnips appeared to collect them most, and from small root systems 30 wireworms were often gathered. Swedes, cabbages, kale, potatoes and mangolds were also good collectors, but not so good as turnips. Beans and peas did not appear to influence them much unless the beans were dibbled and the peas drilled thinly with wide intervals between the drills.

This local movement and its apparent variation with different crops appeared to be connected with :—

- (a) Preference or otherwise for the crop as food ;
- (b) Relative spreading of the root systems of the plants, especially when these are young ;
- (c) The difference of cultural treatment, especially the more or less complete removal of weeds between the drills and the disturbance of the soil.

Migration *en bloc* from one portion of the field to another never took place. For example, turnips, oats and linseed in one field did not affect the average distribution. Frequently damage showed on one crop and not on another, but the general distribution was not altered, for example, potatoes showed damage on one half of a field and oats on the other apparently did not suffer. Oats suffered in another case whereas peas on the same field did not. Beans were apparently unaffected in another field while kales were taken.

Reduction under Cultivation.—The following table shows the reduction in the estimated numbers when grass land was ploughed up and kept under cultivation for a number of years :—

Field Q was ploughed up in 1914 (Autumn), and fields T, M, and 10 were ploughed up in 1918 (Spring). Field 3 was old arable land.

Field.	Estimated number of Wireworms per acre.									
	1914	1915	1916	1917	1918	1919	1920	1921	1922	
Q	900,000	850,000	680,000	440,000	283,500	32,700	21,800	6,000		
T	—	—	—	—	510,000	435,600	331,700	148,000	18,000	
M	—	—	—	—	350,000	238,700	94,000	50,000	15,000	
10	—	—	—	—	215,000	92,600	26,800	30,000	43,600	
3	218,000	—	50,000	—	43,600	—	116,160	—	49,100	

It will be seen that there was a continuous and rapid fall in the wireworm content, especially after the first year under cultivation.

From a study of the cropping of these fields the number 200,000 per acre may be considered the utmost limit for safety as regards damage to crops. From 100,000 to 200,000 will be tolerably safe for cereals, broadcast crops, established plants, or strong spreading rooted crops. Crops such as turnips or any late sown crops which occupy restricted portions of the field, and which are small during the summer months when the wireworms are feeding fast, may be damaged by this number. Below 100,000 wireworms per acre little damage need be feared and below 50,000 it is negligible.

Five years' cultivation appears to be sufficient to reduce the wireworms in ploughed up pastures to unobjectionable proportions. The reason for this will be plain when it is remembered

that they live on an average through five winters. As they are not extensively parasitised at any particular stage, nor likely to be preyed upon at one stage more than another, it is safe to assume that in a field of ploughed up turf they will be present in varying ages from one to five years in approximately equal numbers.

Assuming this to be the case there would be one-fifth normally hatching out into adults each year, and unless eggs were laid the effect on the total would be a diminution of one-fifth, so that even in the most serious cases five years would eliminate them. From a study of these fields this seems to be actually the case and this hatching out of adults and prevention of egg laying is the greatest factor in eliminating wireworms under cultivation.

Under ordinary farm conditions it seems difficult to increase very materially the above rate of elimination. Such birds as rooks and lapwings undoubtedly help a good deal, and so do poultry run on the fields while tillage operations are being carried out, when the soil is loose and the wireworms exposed. Intensive cultivation also helps considerably and shortens the period for elimination of the wireworms. It should be possible under intensive cultivation to shorten the period to three years instead of five, even if the wireworm content be considerably above 500,000 per acre.

The writer has on two occasions reduced to a negligible quantity in one season wireworm contents of 350,000 and 300,000 per acre. By intensive cultivation is meant continuous cropping by hoed crops or frequent cultivation in the brief periods between successive crops.

Cropping of Infested Fields.—A large number of different crops were planted in these fields during the years in question, and a careful record was kept of the effect of wireworms on each crop. The following is a summary of the observations made.

Of cereals oats proved easily the most satisfactory on wireworm-infested land. Where their number was large and there was consequently a considerable loss of plants the older varieties such as Sandy and Clemrothery gave better yields than the modern ones owing to their greater tillering power. Where, however, the loss of plants was not great the new varieties yielded better, although the crop looked much worse. Barley was the worst of the cereals for wireworm land and wheat intermediate. Rye was not tested sufficiently on these fields to enable one to form an opinion.

Beans are a tolerably safe crop where wireworms are numerous. The size of the whole root system compared with

the spacing of the plants makes it unnecessary for the wireworms to move about much. The best crop in the district was harvested on a field with 116,000 wireworms per acre. The only failure of beans was after dibbling very thinly. This practice seems to be unwise on such land.

Peas are nearly as safe as beans on their particular soils, but only if broadcast. Thin drilling in rows is risky, especially when the rows are more than a foot apart. As a rule peas cropped well on the six occasions when they were planted in these fields under observation.

Potatoes usually grow well, but if the wireworms are too numerous there may be gaps due to destruction of seed tubers or sprouts. The soil on ploughed up land is usually sour and on such land the potatoes do well. The looseness produced by the buried turf also favours the crop so that good growth is obtained. A proportion of the crop is holed by the insects and may be spoiled for market. This proportion will necessarily vary with the number of wireworms in the soil.

Swedes, turnips and mangolds are liable to serious damage by wireworms, and such damage will be increased if the rooks discover the field and come after the insects. These crops are drilled at a time when the wireworms are particularly active and they cannot be left unthinned or bulb formation would be prevented. They are very unsatisfactory crops for infested land, and only a specially favourable season producing rapid growth can save them. Of the cabbage tribe kales are the best to grow on such land as they can be left unthinned and still produce abundant forage. The wireworms will do a considerable amount of thinning, in which case neighbouring plants partially fill out the gaps. A crop of cabbages planted on the field from good strong plants can also do well in spite of large numbers of wireworms in the soil, provided the plants be kept growing. Linseed was never damaged on these fields, and in every case yielded the maximum crop that the season and particular soil permitted.

ANGORA RABBIT WOOL PRODUCTION: A PROFITABLE SPARE-TIME OCCUPATION.

W. WATMOUGH.

THE production of Angora rabbit wool has opened a new field to the utility rabbit breeder. This wool is so much in demand by spinners at the present time that 90s. to 40s. per lb. can be readily obtained for it, according to quality. At present the

demand is greatly in excess of the supply, and in order to encourage production enterprising firms of spinners exhibit at the leading rabbit shows displays of garments made from this wool. British spinners are said to prefer the wool produced by breeders in this country to that which is imported from abroad, but as they are unable to obtain home-produced supplies sufficient for their requirements, they are also buying extensively from France and other Continental countries. It therefore appears that the present time is favourable to an increase in the number of Angora rabbit breeders in this country.

The Angora is the only breed of rabbit that has a coat fine enough and long enough to justify its description as "wool" instead of "fur" or "hair." This wool grows rapidly from the time of weaning, and in a mature specimen reaches from 7 to 10 inches in length. It is described by spinners as being the finest material in the world for the weaving of certain classes of garments, *e.g.*, fine underwear, children's coats and caps, and as a trimming for court gowns. Further, the yarn is exported to America and other countries in considerable quantities.

Although Angoras are bred in various colours in addition to white (blues, smokes, fawns, etc.), the whites are the most popular and the most suitable for wool production.

Angoras are clipped about every three months. Approximately, one rabbit produces 10 oz. of wool per annum. Some specimens provide more, but breeders have found by experience that the wool from a single rabbit in one year can safely be calculated to be worth 30s., and that the animal's "keep" during that period will not exceed 10s., leaving a gross profit of 20s. If properly managed, therefore, 50 rabbits are capable of considerably increasing the income of persons who may be in a position to keep them properly.

It is not the writer's desire that anyone at this stage in the development of the Angora wool industry should endeavour to make this branch of live-stock culture his or her sole means of livelihood, but it can certainly be made to augment one's income. Neither does he advise the new enthusiast to aspire to the keeping of a head of rabbits exceeding about 100. Large wool farms may be developed, but they require experienced management, and paid labour has to be employed.

Wool is not the only product of the Angora rabbit. There are two others—pelts and flesh. The white skins are a good imitation of white fox. They are soft, warm and attractive. The pelts also supply the material for the making of necklets, muffs,



FIG. 1.—Angora Rabbit.

stoies, etc., and as linings for certain classes of garments they are said to have no equal. The coloured skins are used for similar purposes.

The meat of the Angora rabbit is excellent for the table. It is described by those who have tasted it as being more delicate, succulent and tender than the flesh of other breeds.

Although money may be made by the sale of the pelts and flesh, the writer's advice is that the rabbits—if suitable—should as a general rule, be kept alive and sheared for their wool. There is another point which all keepers of Angora rabbits should keep before them, and that is breeding for exhibition. Shows are held all over the country at which classes are provided for this breed of rabbit. There they can win many valuable prizes, and in consequence of these successes their value is so greatly enhanced that they may be sold at good prices, as much as £20 and £30 each being sometimes paid for good specimens. Further, a big winning buck can be placed at stud at a remunerative fee, and produce considerable revenue.

Angora rabbit wool is collected by the Universal Angora Club, an organisation of which every breeder should be a member. The wool should be sent to the Hon. Sec. (Mr. J. Holmes, 44, Old Birch, Darwen), who forwards it to the spinners every two months, and the producers receive their cash within a few days of the despatch of each consignment. Mr. Holmes will be pleased to forward particulars of the club and its work to anyone who contemplates commencing with Angoras. The annual subscription to the club is 5s., with 1s. entrance fee.

As regards housing and general management, the Angora differs but little in its requirements from other rabbits, and the necessary information can be obtained from ordinary text-books on the subject, or from the Ministry's Leaflet No. 265. In establishing a stud it is essential that stock of good quality and size should be purchased at the outset. The bucks and does should have coats of even length and fine texture. Rabbits should not be mated when moulty. Angoras are prolific breeders, and the usual litter is from four to eight.

In conclusion, it may be mentioned that Angora rabbit breeding is a particularly suitable hobby or side-line industry for women, among whom are some of the most successful breeders of the day.

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FEBRUARY ON THE FARM.

J. R. BOND, M.Sc.,

Agricultural Organiser for Derbyshire.

Weather.—The popular impression is that February is normally a wet month. Records extending over long series of years prove, however, that for the greater part of England the rainfall, on the average, is lower in this than in any of the other eleven months of the year except April. On well-drained land in the less rainy—the eastern and midland—parts of the country, the soil frequently is at this period dry enough for certain tillage and sowing operations. In the western districts, on the contrary, February is not normally a dry month, and here opportunities for early cultivations are comparatively rare. This difference has something to do with the proportions of arable and grass land on the two sides of the country.

February weather may be either very wet or very dry: in different years it tends towards the extreme in one or other direction. For instance, in 1921 rain fell in Derby on only 5 days during the month, the total rainfall for which was so low as 0.35 inch; but in the following year there were 18 wet days and a total of 3.03 inches of rainfall in the month. Similar variations may occur with regard to temperature. There is thus no certainty about the state of the land at this time of the year. Nevertheless, it not infrequently happens that opportunities missed in February do not return till late in spring; hence the advisability of being prepared to go forward with the sowing of one or other of the crops—rye, beans, peas, spring wheat, barley or winter oats—that may be put in a few weeks in advance of the ordinary spring seedings.

Spring Wheat.—If the farmer has at hand seed of any of the early-ripening varieties of winter wheat, such as Standard Red, Squarehead's Master, Victor or Little Joss, and if the land comes into sowing condition during February, he may sow and reasonably expect to reap a crop similar in yield and time of ripening to the produce of seed drilled late in November. In certain seasons, such as that following the severe winter of 1916-17, early spring sowings may give better results than crops put in before mid-winter.

It might be inadvisable to buy seed of any of the above four kinds for February sowing, excepting perhaps Little Joss. Squarehead's Master does well if sown early enough; but most of the recorded results from spring sowings of this variety

have shown it to be very unsatisfactory and liable to failure when sown after the end of February. Standard Red very closely resembles this variety and may for the purpose of these remarks be regarded as identical with it.

With Little Joss, sowings may if necessary be deferred until about the middle of March. It has been known to yield even better than Red Marvel when sown by the 15th of that month: for instance a farmer who occupied heavy land near Loughborough recently informed the writer that Little Joss sown on the 15th of March had, in 1921, and again in 1922, yielded him 7 quarters per acre, Red Marvel sown at the same time in 1921 producing a quarter less.

If a farmer intended to buy seed wheat now for sowing at the first opportunity, he would be adopting the safest course if he ordered Red Marvel. This variety, while yielding best when sown early, can in the good wheat districts be sown with reasonable likelihood of success at any time to the end of March. Its yields in trials conducted by agricultural educational institutions have been as follows:—

County.		Year.	Date of sowing.	Yield of saleable grain, Bushels per acre.
Essex (Institute)	...	1911	23rd February	53 and 45
"	"	"	20th March	48
"	"	1912	27th "	36 and 42
"	"	1913	11th "	35
Notts. (College)	...	1915	5th "	34
Herts. (Rothamsted) ...		1917	16th "	25 and 28
Yorks. (Garforth) ...		1922	22nd "	20

The usual rate of seeding is 3 bushels per acre, but a little more should be put on when broadcasting. Unless the land is in high condition it should receive a complete dressing of artificials.

February Sown Oats.—Oats sown this month escape the attacks of the frit-fly grub when later sown crops suffer severely; and on light dry land early sown corn often succeeds when crops put in later are badly checked by drought or overtaken by annual weeds, such as charlock and spurrey. Also on heavy land that bakes in the summer, a crop that shades the soil early has a distinct advantage over one that is late in covering the ground. Hardy oats may be preferable to spring wheat in the cooler districts: and on cold soils where neither spring wheat nor barley give satisfactory results, February oats have generally succeeded. Also in upland districts good and comparatively early crops of oats have been

obtained with hardy varieties, sown some weeks earlier than local opinion fixes as the proper time for sowing spring corn in those parts.

There is not quite the same distinction between winter and spring varieties in oats as there is in wheats: spring oats are capable of withstanding or recovering from the effects of moderate frost, while a very severe frost may almost destroy winter oats. Still, there is sufficient difference in hardiness to make it advisable to prefer varieties of the winter or half-bred winter oat class for February sowing. Bountiful (black winter) is the sort most commonly adopted for early sowing in Derbyshire; but the writer has seen good crops of Goldfinder (yellow half-winter) and of Marvellous (white winter) sown at the time in question. Bountiful and Goldfinder are well known to be useful as spring varieties; but when sown in March or April alongside the best spring sorts (such as Crown, Victory or Record) they ripen about a week later and yield rather less than the latter. Ordinary grey winters may also be sown in February or March and may be preferred for poor soils; on good moist land, however, they are too subject to lodging, and under these conditions the stiffer strawed and larger grained varieties are capable of higher yields.

The quantity of seed required differs according to the variety. Grey winters have small seeds and tiller well: 8 bushels per acre will suffice in this case. Marvellous has the opposite characteristics and probably 5 bushels would not be too much with this variety. Goldfinder and Bountiful require about 4 bushels. Special manuring is not, as a rule, called for. As regards cultivations, rolling, even where practicable, is usually inadvisable at this time of the year.

Preparing for Root Crops.—Land that was autumn- or winter-ploughed in unbroken seam often begins to assume a dry aspect early in the season (broken work may lie wet rather longer). This may be an opportunity for cross-ploughing, or of ploughing-back where cross cutting is not permissible. Rightly timed, a second ploughing is beneficial.

Where it has been or still is possible to spread the yard manure on the back of the furrow before cross-ploughing, the manure so applied will have decayed sufficiently and in time to allow of cleaning operations later in the spring. Turnips so manured are held to be less subject to fly troubles than crops to which the manure is applied in the ridges just before drilling. Early manuring affords certain other advantages in

the matter of the method of preparing the seed-bed for root crops.

Clean land intended to grow mangolds on the ridge may with advantage be manured in the ridge at the earliest opportunity in February or March: it is not necessary to wait until the land has been reduced to a fine dry tilth before drawing out the ridges and covering-in the manure. For this crop it is important to have a well-settled bed of soil under the seed.

MANURES FOR FEBRUARY.

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Rothamsted Experimental Station.

Farmers' Field Trials.—Costly mistakes in manuring grass land may often be avoided by conducting a preliminary small scale trial on the field in question. A common case is one where it is uncertain whether basic slag alone will be satisfactory or whether kainit or lime will be required in addition. Under these circumstances, and particularly if the area to be treated is extensive, a season may well be devoted to an experiment. Since in most cases phosphate will certainly be necessary the whole area will receive its dressing of basic slag at the required rate, which would normally be about 7 cwt. per acre of the 30 per cent. grade or its equivalent. A representative plot of about an acre is then chosen and a few drill widths of ground lime is applied across it at the rate of 15 cwt. per acre. The experimental area is then crossed with a similar strip of kainit at about 4 cwt. per acre applied at right angles to the lime. There will then be the following alternatives to choose from:—1. Slag alone; 2. Slag + kainit; 3. Slag + lime; and 4. Slag + lime + kainit. The boundaries of the treatments are marked and the plots kept under observation for a season, when a manurial scheme for the whole area can usually be decided on.

Neutral Sulphate of Ammonia.—Inquiries are often made as to the difference between neutral sulphate of ammonia and the ordinary grade. The neutral material is supplied as a dry powder resembling fine sand in texture; it can be stored for an indefinite time in a dry shed without becoming sticky or lumpy; it contains practically no free sulphuric acid and can therefore be kept in the bags in which it arrives. Ordinary sulphate of ammonia is coarser and damper in texture; it absorbs moisture on storage and tends to form hard lumps; and the small amount of free acid it contains causes the bags to rot.

The neutral grade is always ready for use and since it stores so well it can be purchased when prices are favourable and kept till required. Its dry condition makes it specially suitable for mixing with other fertilisers.

The following are analyses and recent prices :—

Manure.	Ammonia, per cent.	Equivalent to Nitrogen, per cent.	Price per ton, Buyer's Station.	Price per unit N.	Free Acid, per cent.
Neutral Sulphate of Ammonia ...	25½	21.2	£15 2s.	14s. 8d.	.025
Ordinary Sulphate of Ammonia ...	25½	20.8	£13 19s.	13s. 5d.	1 to 3

Manures for Barley.—In working out a scheme for barley it is necessary to consider the effect of the manures on the quality of the grain as well as on the yield. Although season and soil have a much greater influence on quality than differences in manurial treatment, there is some experimental evidence as to the effect of manures, and this is being added to by the present experiments carried out under the research scheme of the Institute of Brewing at many centres throughout the country. Certain of the more definite conclusions from the earlier work may be summarised as follows :—

(1) Nitrogenous manures used alone tend to produce coarse grain of high nitrogen content and low quality. Unfortunately these manures are also the most effective in increasing the yield. The residues of heavy dunging or folding are similar in their action.

(2) Phosphates and potash improve the quality of the grain by increasing its starch and lowering its nitrogen content; but these manures have only a small effect on the yield, and unless used with a moderate supply of nitrogen, present in the soil or artificially applied, they are not likely to be remunerative.

(3) Complete artificial mixtures, such as, for example, 1 cwt. of sulphate of ammonia, 8 cwt. superphosphate, and 1 cwt. muriate of potash per acre, generally give a good yield of grain of high quality. On rich tilths it would be advisable to omit the sulphate of ammonia; on the heavier soils the potash could be reduced by one-half.

Regarding these statements in the light of the previous treatment of the land about to be drilled with barley, the following suggestions may be made :—After well done roots have been carted off, or after a straw crop on land in good condition, nothing will be required. If roots have been fed off by sheep receiving cake, the tilth will probably be too rich to grow first

quality barley, and to counteract rankness 3 cwt. per acre of superphosphate may be given, adding $\frac{1}{2}$ cwt. per acre of muriate of potash or its equivalent on land which is known to respond to potash. After carted roots grown without dung, or after a corn crop on land in only medium condition, a mixture of 2 cwt. per acre of superphosphate and 1 cwt. per acre of sulphate of ammonia would be suitable; while on light gravels and chalks 1 cwt. per acre of muriate of potash (or its equivalent of the lower grade potash manures) would be advisable in addition to the above mixture.

Kainit for Potatoes.—Experience has shown that sulphate of potash is the safest form of potash to use for potatoes where quality is the main consideration, while muriate of potash is slightly inferior in this respect. Lower grade sources of potash such as 12½ per cent. kainit, 20 per cent. potash manure salts, and the various grades of sylvinit are less certain in their action and often give a crop of inferior cooking quality. This detrimental effect is attributed to the common salt which is applied to the soil with the potash when kainit or sylvinit is used. Farmers who have crude potash manures on hand and hesitate to apply them for potatoes in the drills in spring, should consider the possibility of making the applications in winter, or as early as possible in spring, thus allowing the common salt to be washed out by the rain, while the potash is held back in the soil for the use of the potato crop. If a deep furrow is to be given to the potato land, the potash manures had better be applied after this operation to prevent them from being buried too deeply.

It should be noted that the above procedure cannot make crude salts equivalent in their action to sulphate of potash; but crude salts applied in winter should be nearly as effective as an equivalent quantity of muriate of potash applied in the drills in spring.

Leguminous Crops.—Manurial experiments on these important crops have been relatively few, but all evidence goes to show that peas, beans, vetches, clover, sainfoin, lucerne, etc., show a marked similarity in their food requirements. They are all highly sensitive to sourness in the soil, and liming is a necessary preliminary to growing good leguminous crops on soils poor in chalk; their response to farmyard manure either as a direct dressing or even as residues from recent dunging is considerable; good results are obtained from phos-

phates alone on strong land, and from phosphates helped out by potash on light soils; while direct applications of quick-acting nitrogenous manures are often ineffective and may even be harmful.

If the cereal crop which nursed the young clover or sainfoin did not receive a good dressing of phosphate, an application of 4 cwt. per acre of superphosphate or basic slag on stiff land, and of 1 cwt. per acre of muriate of potash (or its equivalent of crude potash salts) in addition on lighter soils, may still be given to the seeds. Lucerne or sainfoin leys that were not manured last year may have a similar dressing.

Spring beans or vetches would benefit from a dressing of dung if any was available, and also about 3 cwt. per acre of superphosphate; but if dung is not used the superphosphate may be increased to 4 or 5 cwt. per acre, and on lighter soils 1 cwt. per acre of muriate of potash or its equivalent should be given in addition to the phosphate.

Top Dressing Grass Land.—Grass land which is to be mown this summer and has not received dung in the previous year, will usually need a spring dressing to give bulk to the hay crop. For this purpose there is available sulphate of ammonia, nitrate of soda, or nitrate of lime. Sulphate of ammonia provides nitrogen at the cheapest unit price and is especially suited to soils which are well supplied with lime; it is retained by the soil and comes into action by degrees as the land warms up; if cold wet weather follows a top dressing there is less likelihood of serious loss when nitrogen is given in this form. The nitrates are dearer when reckoned on their nitrogen content, but against this it must be borne in mind that they yield in the soil compounds of soda and lime which reduce the loss of chalk from the land and also set free some potash for the use of the grass. They are slightly quicker in their action than sulphate of ammonia and should on no account be applied until the grass is capable of making immediate growth. The usual rate of application of these manures is 1 cwt. per acre.

Spring Wheat.—On account of its short period of growth, spring wheat requires more generous manurial treatment than wheat drilled in autumn. Phosphates will be required to give the young plant a good start and to hasten ripening, and for this purpose superphosphate is preferable to basic slag on account of its somewhat quicker action in the soil. A ready supply of available nitrogen should be provided, and this may be given either as sulphate of ammonia mixed with the superphosphate

or as nitrate of soda as a top dressing. Suitable quantities for ordinary conditions would be:—3 cwt. per acre of superphosphate and 1½ cwt. of sulphate of ammonia applied before drilling; or 3 cwt. per acre of superphosphate before drilling and 1-1½ cwt. per acre of nitrate of soda as an early top-dressing. Potash is not required for corn on typical wheat land, but on lighter soils and chalks 3 cwt. per acre of kainit or sylvinite could be applied in addition to the above dressing.

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending January 9th.				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
Nitrate of Soda (N. 15½ per cent.)	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
" " Lime (N. 13 per cent.)	13.15	13.10	13.7	17.3	19.3
Sulphate of Ammonia, ordinary (A. 25½ per cent.)	13.19*	13.19*	13.19*	13.19*	(N)13.5
" " " neutral (A. 25½ per cent.)	15.2*	15.2*	15.2*	15.2*	(N)14.3
Kainit (Pot. 12½ per cent.)	2.5	2.5	2.5	3.7	3.7
" (Pot. 14 per cent.)	2.10	2.6	2.5	2.10	3.7
Sylvinite (Pot. 20 per cent.)	2.15	2.9	2.15	2.9	2.9
Potash Salts (Pot. 30 per cent.)	2.12	2.6	2.12	2.6	2.6
" " (Pot. 30 per cent.)	2.12	2.6	2.12	2.6	2.6
Muriate of Potash (Pot. 50 per cent.) ...	8.5	7.5	7.10	7.15	3.1
Sulphate of Potash (Pot. 48 per cent.) ...	11.5	11.5	11.5	11.5	4.8
Basic Slag (T.P. 35 per cent.)	3.12§	2.1	3.12§	2.1	2.1
" " (T.P. 30 per cent.)	2.17§	1.11	2.17§	1.11	1.11
" " (T.P. 26 per cent.)	2.13§	2.0§	2.13§	2.0§	2.0
" " (T.P. 24 per cent.)	2.9§	1.16§	2.9§	1.16§	1.16
" " (T.P. 20-22 per cent.)	1.13§	2.5§	1.13§	2.5§	2.5
" " (T.P. 18 per cent.)	2.3§	1.15§	2.3§	1.15§	1.15
Superphosphate (S.P. 35 per cent.) ...	3.16	3.7§	3.16	3.7	1.11
" " (S.P. 30 per cent.)	3.9	3.2	3.0§	3.2	2.1
Bone Meal (A. 6, T.P. 45 per cent.) ...	9.10	8.5	8.15	8.0	8.0
Steamed Bone Flour (A. 1, T.P. 60 per cent.)	6.5	6.5†	6.5	6.2	6.2
Fish Guano (A. 10, T.P. 15-20 per cent.)...	12.15	12.10	12.10	12.10	12.10

Abbreviations: N.—Nitrogen; A.—Ammonia; S.P.—Soluble Phosphate; T.P.—Total Phosphate; Pot.—Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

MONTHLY NOTES ON FEEDING STUFFS.

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Sugar Factory By-products.—In the manufacture of sugar from sugar cane or sugar beet, by-products arise which are of value to the stock feeder. Molasses is the important by-product from the sugar cane which is of value to the stock feeder in this country. Notes on the feeding value of molasses have already appeared in these notes, and should be consulted by those desiring further details on the feeding value of this by-product.*

Sugar Beet Slices.—The production of sugar from sugar beet has now reached a commercial stage in England, and considerable quantities of sugar beet slices are now on the market. In the process of manufacturing sugar, the beets are first washed and sliced, the slices being leached in a battery of extractors with warm water. The resultant slices contain very little sugar and may be fed either wet or dry.

Beet slices in their wet state contain 90 per cent. of water, and are chiefly fed to cattle. Fattening cattle and milch cows may be fed up to 50 lb. a head per day, while sheep and pigs may be fed up to 6 lb. per day per 100 lb. live weight. It is said that over-feeding milch cows with wet slices gives rise to hard white butter of inferior taste if the milk is used for butter making. Owing to the fact that wet slices readily decompose, it is usual to dry the slices at the factory at high temperature by means of a rotary drum. The resultant product has a pleasant odour and is greyish-brown in colour.

Feeding Value of Dry Sugar Beet Slices.—Like the wet slices, dried slices constitute a starchy feeding material, and should be fed in conjunction with feeding stuffs rich in protein and oil. If fed soaked the slices may be regarded as a root substitute, if fed dry, as a concentrate. The following quantities may be fed per head per day: Horses 5 lb., cows 7 lb., fattening cattle 10 lb., calves 2-3 lb., pigs 1-3 lb. The slices require soaking for at least 12 hours if it is desired to feed them in the wet state. If fed dry, it is important to accustom the stock to this material by gradually introducing it into the ration.

Description.	Price per Cwt.	a. d. lbs.	Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt. Ton.						
			a. d.	£ s.	£ s.	a.			
Wheat, British	—	—	10/3	10 5	0 16	9 9	71 6	2/8	1 43
Barley, British Feeding	—	—	9/9	9 15	0 12	9 3	71	3/7	1 38
" Canadian No. 4	—	—	—	—	—	—	—	—	—
Western	34/9	400	9/9	9 15	0 12	9 3	71	2/7	1 38
Persian	32/9	"	9/2	9 3	0 12	8 11	71	2/5	1 35
Oats, English, White	—	—	11/-	11 0	0 14	10 6	59 5	3/6	1 29
" Black and	—	—	—	—	—	—	—	—	—
" Grey	—	—	9/4	9 7	0 14	8 13	59 5	2/11	1 56
" Scotch, White	—	—	11/4	11 7	0 14	10 13	59 5	3/7	1 92
" Canadian No. 2	—	—	—	—	—	—	—	—	—
Western	26/9	320	9/4	9 7	0 14	8 13	59 5	2/11	1 56
No. 3	25/9	"	9/-	9 0	0 14	8 6	59 5	2/9	1 47
" Canadian Feed	24/6	"	8/7	8 12	0 14	7 18	59 5	2/8	1 43
" American	24/3+	"	8/6+	8 10+	0 14	7 16	59 5	2/7	1 38
" Argentine	23/9	"	8/4	8 7	0 14	7 13	59 5	2/7	1 38
Maize, Argentine	42/6	480	9/11	9 18	0 13	9 5	81	2 3	1 20
" South African	41/-	"	9/7	9 12	0 13	8 19	81	2 3	1 20
Beans, English Winter	—	—	10/9	10 15	1 12	9 3	67	2/9	1 47
Rangoon	—	—	8/3+	8 5+	1 12	6 13	67	2/-	1 07
Peas, Japanese	—	—	22/6+	22 10+	1 8	21 2	69	6/1	3 26
Millers' Offals:—	—	—	—	—	—	—	—	—	—
Bran, British	—	—	—	7 10	1 7	6 3	45	2/9	1 47
Broad	—	—	—	8 7	1 7	7 0	45	3/1	1 65
Middlings Fine (Im- ported)	—	—	—	10 5	1 2	9 3	72	2/6	1 34
Coarse (British)	—	—	—	9 0	1 2	7 18	64	2/6	1 34
Pollards (Imported)	—	—	—	7 15	1 7	6 8	60	2 2	1 16
Meal, Barley	—	—	—	10 15	0 12	10 3	71	2/10	1 52
Maize	—	—	—	11 0	0 13	10 7	81	2/7	1 38
" South African	—	—	—	9 7+	0 13	8 14	81	2/2	1 16
" Germ	—	—	—	9 15	0 19	8 16	85 3	2/1	1 12
" Gluten-feed	—	—	—	8 17	1 7	7 10	75 6	2/-	1 07
Locust Bean	—	—	—	8 5	0 9	7 16	71 4	2/2	1 16
Bean	—	—	—	12 15	1 12	11 3	67	3/4	1 78
Fish	—	—	—	20 0	4 6	15 14	53	5/11	3 17
Linseed	—	—	—	23 8	1 11	21 17	119	3/8	1 97
Cake, English	—	—	—	13 15	1 18	11 17	74	3/2	1 70
9% Oil	—	—	—	12 0	2 14	9 6	69	2 8	1 43
Soya Bean Cake 6% Oil	—	—	—	7 15	1 15	6 0	42	2/10	1 52
Cottonseed Cake, English	—	—	—	7 10	1 15	5 15	42	2/9	1 47
6 1/2% Oil	—	—	—	—	—	—	—	—	—
Egyptian	—	—	—	—	—	—	—	—	—
5 1/2% Oil	—	—	—	—	—	—	—	—	—
Decorticated Cotton	—	—	—	12 0	2 14	9 6	71	2/7	1 38
Seed Cake 7% Oil	—	—	—	12 7+	2 14	9 13	71	2 9	1 47
Decorticated Cotton	—	—	—	9 15	1 11	8 4	73	2/3	1 20
Seed Meal 7% Oil	—	—	—	7 10	1 3	6 7	75	1/8	0 89
Coconut Cake 6% Oil	—	—	—	6 0	1 4	4 16	71 3	1/4	1 71
Palm Kernel Cake 5% Oil	—	—	—	7 0	0 8	6 12	51	2/7	1 38
Palm Kernel Meal 3% Oil	—	—	—	8 2	1 4	6 18	49	2/10	1 52
Feeding Treacle	—	—	—	7 12	1 4	6 8	49	2/7	1 38
Brewers' Grains:—	—	—	—	1 15	0 9	1 6	15	1/9	0 94
Dried Ale	—	—	—	1 10	0 9	1 1	15	1/5	0 76
Porter	—	—	—	8 10+	1 14	6 16	43	3/2	1 70
Wet Ale	—	—	—	—	—	—	—	—	—
Porter	—	—	—	—	—	—	—	—	—
Malt Culms	—	—	—	—	—	—	—	—	—

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. The manurial value is 21 lbs. per ton. The food value per ton is therefore 2s. 2d. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 224, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1 1/2d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same basis. From the results of such calculations a buyer can determine which feeding stuff gives him the best value, and the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of 100 lbs. of starch equivalent.

From the point of gauging the price, roots form the best comparison. From experiments carried out at Little Snoring with fattening cattle some years ago, it would appear that 14 lb. of dried slices are equivalent to 1 cwt. of roots in feeding value.

FARM VALUES.

CROPS.	Market Value per lb. S.E. d.	Value per unit S.E. s. d.	Starch Equivalent per 100 lb.	Food Value per Ton. £ s.	Manurial Value per Ton. £ s.	Value per Ton on Farm. £ s.
Wheat	1 20	2 3	71.6	8 1	0 16	8 17
Oats	1 20	2 3	59.5	6 14	0 14	7 8
Barley	1 20	2 3	71.0	8 0	0 12	8 12
Potatoes	1 20	2 3	18.0	2 0	0 4	2 4
Swedes	1 20	2 3	7.0	0 16	0 2	0 18
Mangolds	1 20	2 3	6.0	0 13	0 3	0 16
Good Meadow Hay	1 52	2 10	31.0	4 8	0 14	5 2
Good Oat Straw	1 52	2 10	17.0	2 8	0 7	2 15
Good Clover Hay	1 52	2 10	32.0	4 11	1 0	5 11
Vetch and Oat Silage	1 38	2 7	14.0	1 16	0 7	2 3

With reference to the note in the January, 1924, issue of this *Journal*, p. 887, relating to the closing of the Cattle Testing

**Importation of
Live Stock into
South Africa.**

Station at Pirbright, Surrey, the Government of the Union of South Africa has prohibited the importation of cattle, sheep, goats and pigs from the United Kingdom, owing to the prevalence of foot-and-mouth disease. The regulations mentioned in the note above referred to are therefore in abeyance for the present.

The thirteenth Report of the Development Commissioners, for the year ending 31st March, 1923, has just been issued by H.M. Stationery Office.* It contains a valuable record of the effort that is being made by the State to improve British agriculture by means of a complete system of education and research.

The purposes for which grants are at present given are as follows:—

- (1) Research Institutes and Stations, each dealing with a separate group of problems.
- (2) A staff of scientific men for advising farmers in their technical difficulties.
- (3) Special research grants to individual research workers.
- (4) Fellowships to enable members of the staffs of the Research and Advisory service to travel and study the methods of other scientific workers; and scholarships for training young graduates.
- (5) Agricultural education—building and equipment of colleges, extension work of colleges, farm institutes and classes provided by Local Education Authorities, scholarships.
- (6) Miscellaneous agricultural schemes.

The total amount recommended by the Commissioners for expenditure on agriculture and rural industries in 1922-3 was approximately £488,000, of which £16,450 was loaned. £214,000 of the total was provided by the ordinary Development Fund, and the remaining £224,000 came from the special grant of £850,000 which was paid into the Development Fund under the Corn Production Acts (Repeal) Act, 1921.

The New Fund.—The principal feature during the year 1922-23 was the allocation of this £224,000 from the new fund. The chief objects for which advances from it were made are:—

- (1) Additions to the lands and improvements to the buildings at research institutes and agricultural colleges.
- (2) Extension of the advisory scheme.
- (3) Increase of help to local authorities for agricultural education.
- (4) Provision for scholarships for children of agricultural workers.
- (5) A scheme for the development of the poultry and livestock industry.

Agricultural Economics Service.—This service, an extension of the Advisory Scheme, has been inaugurated during the year with the object of providing economic guidance for farmers. Economic studies were already being carried out at the Oxford Institute for Research in Agricultural Economics, and Leeds

* To be obtained directly or through any bookseller from H.M. Stationery Office, Kingsway, London, W.C.2; or Manchester, Edinburgh and Cardiff. Price 4s. net.

University had given much attention to the subject.* The scheme provided for the enlargement of the Leeds department and the creation of new costings departments at Cambridge University, Reading University College, and Wye College. These will all work in conjunction with the Oxford Institute, and in the first instance will concentrate on preparing cost accounts for selected farms on a common plan.

National Poultry Institute.—The grant of £850,000 enabled those associated with the poultry industry to bring forward a scheme for the establishment of a long-desired poultry institute. Originally the promoters had in view the foundation of a single central institution, but a full examination of the project by the Ministry and its Poultry Advisory Committee led to the conclusion that better results would be got by dividing up the problems which face the poultry keeper under separate headings, most of which could be more effectively dealt with at existing institutions than at a single central institute. Accordingly a scheme has been adopted for work to be done on poultry nutrition at the Cambridge Animal Nutrition Institute, on diseases at the Ministry's Veterinary Research Laboratory, on breeding at the Cambridge University Department of Genetics, and on education and commercial problems at the Harper Adams Agricultural College. The capital required for buildings and equipment at these places is estimated at £26,000 and maintenance at £6,000 per annum. The Development Commission will provide three-fourths of the capital and the whole of the annual expenditure which they consider necessary.

National Federation of Women's Institutes.—This organisation has continued to show great vitality and powers of expansion, 455 new Institutes having been formed during the year 1921-22 and 347 during 1922-23, bringing the total number in existence up to 2,674 with a membership estimated at 160,000. The number of voluntary organisers trained by the Federation increased during the same period from 146 to 215. The formation of county federations has been further extended, the work being completed in the English counties, and only five Welsh counties being without federations. It should be borne in mind that the individual Institutes finance themselves and contribute to the maintenance of the headquarters staff and the county federations, and that the grant from the Development Fund goes

* See this Journal:—*The Cost of Manual Labour in Milk Production*, August, 1922, p. 411; *Labour on the Farm*, Nov., 1922, p. 697, and Dec., 1922, p. 801; *When should the Farmer sell Home-Grown Foods*, Dec., 1922, p. 783; *Farm Capital and Profits*, Feb., 1923, p. 884.

towards the cost of organisation. It is a satisfactory sign of the strength of the movement that, in spite of the depressed condition of the agricultural workers, the call on public funds becomes less each year. For 1921-22 a grant of £7,250 (including £600 for training in handicraft work) was sanctioned by Your Lordships. For 1922-23 a grant of £4,825 (including £700 for handicraft purposes) was approved, but of this only £3,941 was actually paid over, while for 1923-24 it was found possible to reduce the grant to £3,456, of which £856 was for handicraft instruction. This progressive reduction was due partly to economies effected by the headquarters organisation and partly to an increase in the revenue derived from affiliation fees, interest on the endowment fund, donations and sales of literature, which actually amounted to £3,781 for the year 1922-23, and was estimated at £4,350 for the year 1923-24. At the end of the year 1922-23 the Endowment Fund stood at approximately £14,115. The Federation is now extending its handicraft teaching to others besides Institute members. Classes for men and boys will be given by teachers trained at the Handicrafts Schools, and an effort will be made to organise the production of work for sale (as distinct from recreational and thrift work) by village women wherever the demand arises. It is hoped that this may do something to relieve distress arising from the depression in agriculture.

Agricultural Education.—A striking result obtained from the new fund is the re-establishment of the Royal Agricultural College, Cirencester, which was closed during the War, as nearly all the staff and students had joined the Forces. The Development Commission recommended a capital grant of £15,000 for extending the existing buildings, and £2,000 in aid of the first year's maintenance, and the College was re-started at the beginning of the academic year with a good entry of students.

Scholarships for Agricultural Workers.—£100,000 of the new fund has been allocated to establishing scholarships and maintenance allowances for the sons and daughters of agricultural workmen and others. The Ministry of Agriculture and the Board of Education set up a Committee to prepare a scheme for the expenditure of this sum, and as a result, ninety-two scholarships were awarded for 1922-23, at an estimated cost for that year of £10,000. For the next year £20,000 has been approved.

The above are no more than examples of the work supported by the Development Fund. All who are interested in agricultural development will find in the complete report an illuminat-

ing account of the progress already made in agricultural research and education and the prospects opened up by it.

With a view to encouraging small holders in the best methods of cultivating their holdings, prizes have been offered at some recent agricultural shows for the best cultivated small holdings in the district. One of the Ministry's District Commissioners has seen the prize-winning holdings under a competition of this kind organised by the Hertfordshire Agricultural Society, and reports that they do the tenants great credit. Similar competitions have been or are about to be arranged in connection with several other agricultural shows, including that of the Bath and West and Southern Counties Agricultural Society, and these should have a very stimulating and beneficial effect on the small holders in the districts concerned.

It is interesting in this connection to note that several cases have been brought to the Ministry's notice where prizes of various kinds in open competitions have been won by tenants of County Council small holdings. A Westmorland holder was successful with a pen of ducks bred by him in winning the *Daily Mail* Cup in 1923 in an Egg-Laying Competition over a period of twelve months open to Britain. Numerous successes by tenants of the Leicester County Council have been obtained at various live-stock shows in the county during the past year, and the possibility of organising special classes for small holders at next year's shows in Leicestershire is under consideration.

A further instance of the enterprise and success of small holders is afforded by the fact that no fewer than 76 entries by tenants of the North Riding of Yorkshire County Council were made at the Rural Industries Exhibition, and 5 first, 7 second, and 7 third prizes were secured, chiefly for roots and ears of corn.

The general index number of the prices of agricultural produce showed a further slight advance in December, the average increase over the corresponding month in the years 1911-13 being 56 per cent. as against an increase of 53 per cent. in November. The rise during the past two months has thus brought the general level of prices to only 3 points below that of December, 1922.

In the following table are shown the percentage increases monthly since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

Month.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	53
August	193	131	67	54
September	202	116	57	56
October	194	86	59	51
November	193	79	62	53
December	184	76	59	56

Following the improvement in wheat prices which occurred during November, the December figure showed a further decided advance, averaging 88 per cent. above the pre-war price as against 22 per cent. in November. The end of the month witnessed a somewhat easier tendency, however. Oats also realised considerably higher prices than in the previous month, but barley was slightly cheaper, although the fall was less pronounced than is customary at this period.

Potatoes again advanced, December prices being nearly £1 per ton higher than those for October, and little less than double the pre-war average. There is no weakening in the markets, and further advances are probable in the near future. Hay remains at about its pre-war level.

Fat cattle and sheep advanced in value in December, but whereas the rise in cattle prices was relatively greater than the normal increase before the war, sheep advanced by less than the pre-war average. Hence the index figure for cattle shows a rise on the month, while that for sheep shows a fall. Fat pigs continued the downward trend which had only twice been interrupted since the beginning of the year. The prevalence of foot-and-mouth disease and the consequent restrictions imposed upon trade, prevented the calculation of average prices of store stock and dairy cows in December.

The main cause of the advance of 3 points in the general index number was the rise in milk prices. Under the National Farmers' Union scheme producers received 1s. 8d. per gallon in December, for milk delivered to buyer's station, as compared with 1s. 5d. in November, and although the scheme is not operative throughout the country and has not been universally

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MANURES FROM TOWN WASTE

[Feb.,

adopted, the general level of prices rose from 76 per cent. above the pre-war average in November to 90 per cent. in December. Butter also advanced, but cheese was slightly cheaper than in November.

A substantial advance was recorded in poultry prices during the month, far exceeding the normal pre-war increase at this season, with a resulting increase of 19 points in the index number. Eggs, on the other hand, declined to a relatively greater extent than was usual before the war, and the index number for December is 6 points lower than that for November.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1922.			1923.		
	Dec.	August	Sept.	Oct.	Nov.	Dec.
Wheat ...	32	29	19	20	22	33
Barley ...	17	9	30	25	25	27
Oats ...	36	30	30	25	24	30
Fat cattle ...	48	46	45	44	47	49
Fat sheep ...	81	76	72	76	77	72
Fat pigs ...	94	52	55	48	47	43
Dairy cows ...	72	51	52	61	57	—
Store cattle ...	28	28	27	27	25	—
Store sheep ...	83	101	109	99	88	—
Store pigs ...	151	102	95	82	75	—
Eggs ...	63	68	75	92	92	86
Poultry ...	86	61	67	65	58	77
Milk ...	90	67	67	72	75	90
Butter ...	73	48	56	61	64	68
Cheese ...	60	67	74	76	73	71
Potatoes ...	7	80	75	62	80	91
Hay ...	47	34	32	7	—1*	0

* Decrease.

THE Corporation of Birmingham has long been noted for its municipal activities. Its gas, electric light and water departments have all been very successful, but a department which has only been running a few years and deals with town waste is of special interest to farmers, who, however, have not yet made the direct use of it that they might.

Under the direction of Mr. J. Jackson, its Superintendent, a great "Wealth from Waste" campaign has been started by the Salvage Department, and as a result, manures and feeding stuffs

of various types are now available at a reasonable rate. For instance, 4,000 tons of slaughter-house and similar material is dealt with every year, yielding nearly 1,000 tons of the finished product. This includes fish and meat meals with 51 per cent. of albuminoids, together with fish, meat, bone and other manures with varying analyses, which are priced according to the unit value.

What is known as slaughter-house manure contains 6 to 7 per cent. of ammonia and the same percentage of phosphates, and is offered at £8 10s. f.o.r. Birmingham. It is produced from the stomach contents of various beasts and contains a large amount of humus in the form of fibre. In other forms the fibre is taken out so that the manure can be drilled. The fibre is in great demand by hop and fruit growers. One of the most interesting of the productions, although naturally there is only a limited supply, is the ash made by burning banana stalks. This fertiliser contains 50 per cent. of potash.

Farmers in the neighbourhood of Birmingham have produced good crops by the use of these products. There is no trouble in getting rid of the 17 to 18 tons that are available each week, and most of it is readily sold to middlemen who apparently use it for compounding artificial manures.

Another material which can hardly be called manure, but which is very useful on heavy land, is the dust from household refuse, which has passed through a $\frac{3}{8}$ -in. sieve. At present it only contains 1 per cent. of nitrogen and 1 per cent. of phosphates, but it is hoped to increase this percentage by adding vegetable refuse. At present this can be delivered within a few miles of Birmingham at 4s. or 4s. 6d. per ton.

The Department has an analytical laboratory with a trained staff and is able both to analyse the various materials and to give advice as to any necessary additions which should be made for specific crops. Not only farmers but allotment holders are catered for by this Department, and prices are quoted for quantities as low as 14 lb. either at the depot or delivered anywhere in Birmingham for a few pence extra.

* * * * *

The Treasury, on the recommendation of the Development Commissioners, have approved grants to Agricultural Research Grants to Institutes for work to be carried out during Research the year ending 30th September, 1924, as Institutes shown in the statement below:—

Institute	Amount Sanctioned, £
Aberystwyth: Plant Breeding Institute	5,800
Bristol: Agricultural and Horticultural Research Station	11,800
Cambridge: Animal Nutrition Institute	9,700
Plant Breeding Institute	5,600
Small Animal Breeding Institute	1,180
Horticultural Research Station	1,420
Silver Leaf Research	1,550
East Malling Research Station	6,300
Imperial College of Science and Technology	5,100
London School of Tropical Medicine	2,550
Oxford: Institute for Research in Agricultural Economics	4,950
Reading: National Institute for Research in Dairying	8,800
Royal Veterinary College	4,500
Rothamsted Experimental Station	22,780
Waltham Cross Experimental Station	2,000
	<hr/> 493,170

It is not surprising that goat-keepers should have taken note of the success of the Ministry's scheme of milk recording for cows. The more advanced goat breeders have come definitely to the conclusion that milk recording for them has become a necessity if they are to improve their milking herds and keep abreast of the times.

For some years the subject has been discussed in the goat press, and about four years ago the Ministry agreed that goats might be recorded under its scheme on the same conditions as cows, if the milk recording societies concerned considered the size of the herd would justify the labour and expense incurred in checking the records.

As a result of this permission, eleven goat owners recorded 85 goats during the year ending 1st October, 1922, and nearly double that number of goat owners are now recording under the official scheme.

These eleven owners are members of six different milk recording societies. Of the five herds which were recorded for the full year of operations, four herds contained goats which gave records of between 200 and 800 gallons.

Under the official scheme the cost per head of recording is of course much higher, proportionately, for goats than for cows, taking into account the respective values of the animals and the amounts of milk given. The goat keeper is also adversely affected by the fact that herds of goats are on an average very much smaller in numbers than are herds of cows. Thus

the minimum charge per herd which is made by milk recording societies is not always reached by the total of the subscriptions and the levies for each goat entered.

The fact that milk recording for goats is advancing in spite of these obstacles indicates strong belief among goat owners in the value of membership of a Society recognised by the Ministry.

Subscriptions and levies charged by milk recording societies vary considerably in different parts of the country. The following are the charges made by those societies under which goats are recorded:—

Society.	Subscription.		Levies.	
			5/- per head	*Min. £5 10 6 per herd
Surrey	...	10/6	...	5/-
Hants	...	5/-	...	"
Essex	...	£1 1 0	...	3/-
Northants	...	10/6	...	"
Lanes	...	£2 0 0	...	4/6
Worcester	...	£1 0 0	...	5/-

* Minimum.

AGRICULTURE ABROAD.

This new potato wart disease order, issued by the Prussian Minister of Agriculture on 27th September, 1922, is an amendment of that of 18th February, 1918, and

Wart Disease Regulations in Prussia.*

applies to the entire State of Prussia.

Potato fields and stored potatoes are liable to inspection, with a view to the control of wart disease [*Synchytrium endobioticum*]. Inspection may be extended to fields intended for potato cultivation or which have already been harvested. It will be carried out by the local police authorities and officials of the plant protection headquarters. The inspectors are authorised to remove suspected tubers, etc., for examination. Owners and occupiers of ground and stores or their representatives observing symptoms of wart disease (described in an appendix), on growing or stored potatoes are required to notify within 24 hours the police or local authorities, who in their turn must immediately inform the plant protection headquarters. The decision of the latter or their representatives is final.

The refuse of plants growing in infested fields must be carefully collected and burnt, or buried at least half a metre deep where burning is impossible. Potatoes harvested from infested fields must neither be used for seed nor removed from their

* See *Nachrichtensblatt für den Preussischen Pflanzenschutzdienst*, ii, 12, pp. 102-104, 1922.

place of growth without permission from the police, issued on approval by the plant protection headquarters. They can only be used for fodder when cooked or steamed. The residue from such potatoes must also be burnt. Where factories for the preparation of potato products are near by, it is best to hand over the tubers from contaminated fields to such factories, but any unnecessary movement of the tubers is to be avoided on account of the danger of transmitting infection in particles of soil adhering to them.

Only the potato varieties specially authorised by the local police authorities may be cultivated in infected fields until further notice. Removal of such restriction must be approved by the plant protection headquarters. The only varieties admissible for this purpose are those listed as immune from wart disease in the annual circular of the Biological Institute. Seed potatoes are to be procured only from fields approved by a Chamber of Agriculture, the Potato Cultivation Society, the German Agricultural Association, or the National Agricultural Federation. Stable or liquid manure must not be sold by, or otherwise distributed from, infected farms. Cellars and other rooms employed for the storage of diseased potatoes must be disinfected with limewash after use.

The above regulations do not apply to official experiment stations, in the case of scientific research, or to the removal of samples by the inspection authorities.

In case there is ground for suspicion that the infection has been, or is likely to be, transmitted to other fields, the above regulations may be applied to all the fields within an area to be defined by the police authorities in accordance with the finding of the plant protection headquarters.

If infected potatoes are found elsewhere than on agricultural premises the stock must also be rendered harmless or disposed of for manufacturing purposes under the supervision of the local police authorities.

A note in this *Journal*, September, 1923, p. 560, described a French and Belgian system of competitions intended to secure the widespread adoption of the results of modern research in crop breeding. Competitions with the same object have also been carried on in the Canadian province of Quebec since 1919.* These competitions are designed to encourage the use for seed of the grain produced.

* *Agriculture Gazette of Canada*, Sept.—Oct., 1923.

Farmers desiring to enter the competition are required to own a certain amount of seed grain of standard quality and of a known variety approved by the Department of Agriculture. The standing crops entered by their growers are inspected and points are given for the general appearance of the crop, absence of weeds and diseases, system of cultivation, etc. The interesting feature of the competitions is that the farmers are then required to prepare a large proportion of the grain for seed. An inspection of the cleaned seed is made and points given according to the thoroughness of the work done during the course of all the operations.

This constitutes the difference between the combined field crop and cleaned seed competition and the former standing crop competitions, and prevents well-to-do farmers from putting their crops into the competition as a speculation without any results as regards the improvement of cereal crops by the more general use of improved seed.

The contests are organised under the auspices of the agricultural associations, with the co-operation of the Provincial Department of Agriculture. During the three years, 1920-23, the annual number of competitions has increased from 16 to 29 and the entries from 472 to 1,297. In the third year 28,400 bushels of seed oats and 7,500 lb. of clover seed were inspected.

The increase in the number of contests and entries suggests their popularity among farmers and the benefits derived from them. The consensus of opinion is that the competitions are a means of distributing good varieties of crops among the farmers, that they encourage the use of methods of selection, and create an élite of farmers who are able to produce seed of good quality of uniform variety, and well adapted to climatic and soil conditions. It is hoped that as the work becomes generalised throughout the province the average yield of crops will show a decided increase.

A Commission of Investigation has recently been inquiring into the organisation of the system of distributing foodstuffs in Sweden. In its report, it states that owing to the increase in prices during the War and the withdrawal of State control thereafter, middlemen found themselves in a position to obtain unreasonable profits in many directions. Latterly, however, values had considerably declined, and with the unusually abundant supplies of goods,

**Agricultural
Prices and
Distribution in
Sweden.**

the evil had to a large extent disappeared. In consequence the Commission did not recommend any interference by the State with ordinary economic conditions in Sweden at the present time. It did, however, recommend that Local Authorities should make themselves acquainted with the local circumstances of important trades and assist them where they could in reducing expenses through representations to transport authorities, etc. The Commission expresses its firm conviction that the co-operation of consumers and producers forms the best means of removing any undue expense of intermediate services in the marketing and sale of commodities, and it recommends that an intensive educational campaign should be carried out to bring the fact home to those concerned.

The Commission also submitted that the Government should (1) order that a continuous service of statistics of producers' prices should be organised; (2) that Communal Prices Committees should be set up to watch prices in towns or districts; (3) that obligatory instruction in economic theory and practice be given in suitable schools; (4) that Parliament should vote 10,000 crowns annually as a contribution to a central organisation for the development of economic co-operation.

* * * * *

Foot-and-Mouth Disease.—Since 12th December, 1923, the following fresh centres of disease have been brought to light :—

- (1) On 15 December, Deal, Kent.
- (2) " 18 " Ulverston, Lancs.
- (3) " 19 " Norwich.
- (4) " 24 " Whitehaven, Cumberland.
- (5) " 29 " Boreham, Chelmsford.
- (6) " 30 " Salby, Northants.
- (7) " 30 " Mildenhall, Suffolk.
- (8) " 30 " Macduff Gamrie, Banff.
- (9) " 31 " Aldborough, Yorks, E.R.
- (10) " 4 January, Silverstone, Northants.
- (11) " 8 " Carmythe, Forfar.
- (12) " 12 " Ely, I. of Ely.
- (13) " 14 " Kirby Stephen, Westmorland.

Outbreaks.—The table on p. 1077 shows the number of outbreaks during the period 12th December, 1923, to 19th January, 1924, inclusive, and during the outbreak from 27th August last.

Restrictions.—With the release of the controlled area on 15th December, 1923, the general restrictions, so far as movement of animals is concerned, have remained practically unchanged, save for the variation of the limits of the infected areas from time to time on account of the new outbreaks or of the cessation of disease in some districts.

FOOT-AND-MOUTH DISEASE, 1923-1924.

England and Wales	Dec. 12-15.	Week ending Dec. 22.	Week ending Dec. 29.	Week ending Jan. 5.	Week ending Jan. 12.	Week ending Jan. 19.	Total during Outbreak from 27 Aug., 1923, to 19 Jan., '24.
Bedford	—	—	—	—	—	—	1
Birmingham	—	—	—	—	—	—	6
Cheshire	137	190	212	160	110	63	1,312
Cumberland	—	—	—	—	—	—	14
Denbigh	1	8	3	3	3	—	79
Derby	1	1	3	3	3	3	21
Devon	—	—	—	—	—	—	4
Durham	10	5	2	1	4	2	91
Essex	—	—	—	—	—	—	6
Flint	3	14	6	4	7	5	77
Gloucester	5	5	4	—	3	4	59
Isle of Ely	—	—	—	—	1	—	1
Kent	1	3	—	—	1	—	8
Lancaster	2	9	12	8	8	5	79
Leicester	—	1	2	2	2	1	15
Lincoln, Lindsey	—	—	—	—	—	—	2
London	—	—	—	—	—	—	1
Monmouth	—	—	—	—	—	—	1
Norfolk	—	1	—	2	2	—	10
Northampton	—	—	—	2	—	—	5
Northumberland	5	7	4	3	5	4	71
Nottingham	—	—	2	—	—	—	3
Salop	11	20	20	19	16	9	151
Somerset	—	—	—	—	—	—	7
Southampton	—	—	—	—	—	—	7
Stafford	1	6	18	21	10	4	71
Suffolk	—	—	—	2	1	—	3
Surrey	—	—	—	—	—	—	7
Sussex, East	—	—	—	—	—	—	1
Warwick	3	1	2	4	—	1	13
Westmorland	—	—	—	—	—	1	1
Worcester	2	5	2	3	3	1	26
York, East Riding	—	—	—	1	1	3	8
„ North „	—	3	7	4	2	1	22
„ West „	5	7	6	3	1	2	85
TOTALS — England and Wales	187	286	312	250	187	113	2,268

Scotland	Dec. 12-15.	Week ending Dec. 22.	Week ending Dec. 29.	Week ending Jan. 5.	Week ending Jan. 12.	Week ending Jan. 19.	Total during Outbreak from 27 Aug., 1923, to 19 Jan., '24.
Aberdeen	—	—	—	1	—	—	4
Ayr	1	—	—	—	—	—	4
Banff	—	—	—	2	3	—	5
Dumbarton	1	1	—	—	—	—	23
Kinross	—	—	—	—	—	—	1
Fife	1	—	2	1	—	—	5
Fo. far	—	—	—	—	1	—	1
Lanark	4	1	3	2	2	2	26
Perth	—	—	—	—	—	—	5
Benfrew	—	—	1	—	—	—	25
Stirling	—	1	2	—	—	—	14
TOTALS — Scotland	7	3	8	6	6	2	115
TOTALS — Great Britain	194	289	320	256	193	115	2,383

As from 4th January, 1924, a consolidating Order was issued restating the various areas, other than those in the North Midlands (Ches. &c., Area), Kent, Renfrew district, Fife and Perth district, Aberdeen-shire, and Forfarshire, comprised under separate Orders.

Restrictions on Hunting.—On 18th December, 1923, a Circular Letter was issued by the Minister intimating that in consequence of strong representations from the National Farmers' Union and from farmers individually, it had been decided to issue an Order prohibiting hunting in infected, controlled or prohibited areas. The Order, which operated on 24th December, also prohibited whippet-racing and coursing.

Restrictions on Imported Animals.—On the 20th December the Ministry extended the period of detention at the farms of destination of all imported animals from 14 to 28 days. The movement of imported animals is now permissible only direct to a slaughterhouse for slaughter therein, or to private premises for detention for the period specified, during which no movement is permitted.

World's Poultry Congress, 1924.—People who are interested in the development of the British Poultry Industry should bear in mind the World's Poultry Congress and Exhibition, which will be held in Barcelona and Madrid in May next. Programmes are now available for this gathering of poultry-keepers from all over the world, and there is sufficient evidence forthcoming to indicate that the Congress will not only be of great interest to all who attend it, but that it may prove to be a unique opportunity for British breeders to secure fresh markets abroad.

Special terms and arrangements are being made for those who wish to attend the Congress from this country. The outward journey would be via London, Newhaven, Dieppe, Paris, Port Bon, and Barcelona, returning via Madrid, Burgos, Biarritz, Paris, Dieppe, to London. The special fares are as follows:—1st Class, £12 18s. 9d.; 2nd Class, £9 5s. 2d. (Sleeping berths extra, also the cost of transfer between stations in Paris.) The journey to Barcelona and on to Madrid must be taken by the party (of not less than 25) without a break, but the return journey can be made at will and be broken to see places of interest en route. Application for tickets and further particulars should be made to Mr. T. R. Robinson or Mrs. Rawson, at 3, Vincent Square, London, S.W.1.

It is to be hoped that this country will be adequately represented at the Congress, for delegates will be coming from 30 countries who have signified their intention of being officially represented. South America in particular will be well represented by prospective buyers. There is also some promise that a good market for high class poultry stock could be found in Spain itself.

Registers of Growers of Certified Immune Varieties of Potatoes in 1923.—During the past season, Inspectors of the Ministry of Agriculture have examined many fields of growing potatoes of varieties immune from wart disease, with a view to certification of the crops under the Wart Disease of Potatoes Order of 1923 as true to type and free from "rogues." A list of growers of these certified stocks has been prepared and copies may be obtained, price 1s., from the Ministry, which will also be happy to supply on application the names and addresses of growers of certified stocks of any particular variety, together with the numbers of the relative certificates. Growers

are reminded that only "seed" from crops which have been so certified may be planted on land which is infected with wart disease.

The Board of Agriculture for Scotland has issued a similar register of Scottish growers with the acreages and kinds of potato crops certified, together with certificate numbers. Copies can be obtained from the Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh, price 2s. net, post free.

REPLIES TO CORRESPONDENTS.

Period of Growth of Crops.—V.W. asks for information as to the average time in which various crops become available after dates of sowing.

Reply: It is almost impossible to give any categorical information on this subject. Much will depend on the variety sown as well as on climatic, soil and weather conditions. For instance, at Rothamsted Experimental Station, in 1922, two crops of Red Standard Wheat sown within five days of each other (on 24th October and 29th October, 1921) were carted respectively on 7th September and 26th September, 1922. Plumage Archer Barley in 1921 was carted in a day over five calendar months from sowing; in 1922 the same crop on the same field took practically six months from sowing to harvest.

Starch Equivalent and Albuminoids.—X.Y. asks for information.

Reply: The significance of these terms is explained in the introduction to the Ministry's Miscellaneous Publication No. 32 (*Rations for Live Stock*). In compounding rations, regard must be had to the proportion of digestible protein (albuminoids) to starch equivalent. This is explained, as regards the feeding of dairy cows, in Leaflet No. 338, and, as regards pigs, in Nos. II and III of a series of articles on Pig-Keeping in this Journal. (The articles referred to appeared in the October and November issues of last year.) In purchasing feeding stuffs, the simplest guide to money value is the starch equivalent. See the table published monthly in this Journal.

Pollination of Vegetable Marrow.—B.D. inquires as to this.

Reply: The Vegetable Marrow may safely be said to be normally insect-pollinated. Knuth (*Handbook of Flower Pollination*, vol. 2) does not expressly refer to the Vegetable Marrow, but mentions the honey-bee as frequently visiting the flowers of the Pumpkin, which belongs to the same genus as the Vegetable Marrow. On the general question of insect-pollination correspondent was referred to Lord Avebury's *British Wild Flowers considered in Relation to Insects*.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

- Russell, Sir E. J. and others.—*The Micro-Organisms of the Soil*. [Rothamsted Monographs on Agricultural Science.] (195 pp.) London: Longmans, Green & Co., 1933, 7s. 6d. net. [63.115(52).]
- Bornemann, F.—*Kohlensäure und Pflanzenwachstum*. 2te Auflage. (138 pp.) Berlin: Paul Parey, 1933. [59.11(04); 63.168(04).]
- Wiest, E.—*Agricultural Organisation in the United States*. (640 pp.) Lexington: University of Kentucky, 1933. [55(73); 63(79).]
- Brutten, A.—*International Institute of Agriculture*.—*Uses of Waste Materials: The Collection of Waste Materials and their Uses for Human and Animal Food in Fertilisers and in Certain Industries*, 1914-22. (387 pp.) London: F. S. King, 1933, 12s. [56.16(02); 63.16(03); 63.60(52)(03); 63.60(53).] Reviewed in the January issue of this Journal.

